

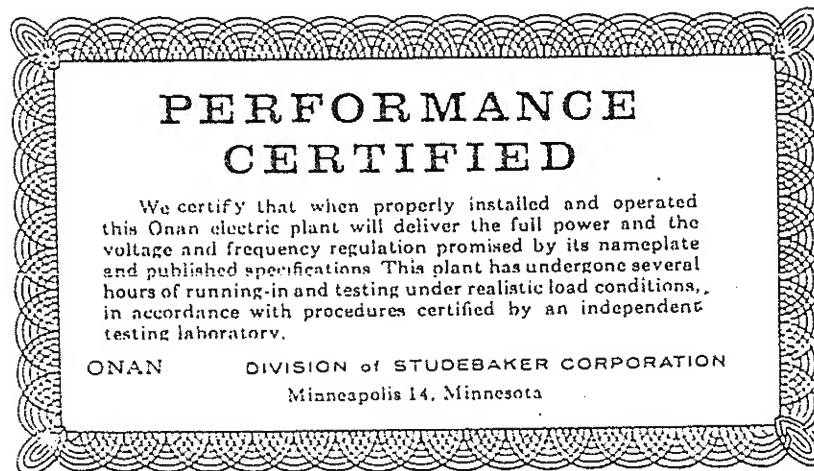
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ONAN ELECTRIC GENERATING PLANTS CCK SERIES

927-300

11AJ65



IMPORTANT...RETURN WARRANTY CARD ATTACHED TO UNIT

GENERAL INFORMATION

THIS OPERATOR'S MANUAL PROVIDES INFORMATION FOR PROPER INSTALLATION, OPERATION, AND MAINTENANCE PROCEDURES.

WE SUGGEST THIS BOOK BE KEPT HANDY SO THAT IT CAN BE READILY REFERRED TO WHEN NECESSARY, EITHER FOR ORDERING PARTS OR MAKING PLANT ADJUSTMENTS.

FOR MAJOR REPAIR INFORMATION, USE THE FORM PROVIDED BELOW. A SERVICE MANUAL WILL BE SENT UPON RECEIPT OF \$1.00. INDIVIDUAL WIRING DIAGRAMS ARE AVAILABLE AND WILL BE INCLUDED, WHEN REQUESTED.

PLEASE!

WHEN FILLING OUT THE FORM, BE SURE YOU HAVE INDICATED THE MODEL AND SPEC NUMBER, AND THE SERIAL NUMBER EXACTLY AS SHOWN ON THE UNIT NAMEPLATE. THIS INFORMATION IS NECESSARY TO PROPERLY IDENTIFY THE UNIT AMONG THE MANY BASIC AND SPECIAL MODELS MANUFACTURED.

TRIM ALONG THIS LINE

ONAN
DIVISION of STUDEBAKER CORPORATION
2515 UNIVERSITY AVENUE S. E. MINNEAPOLIS 14, MINNESOTA

I ENCLOSE \$1.00. PLEASE SEND ME A
MAJOR SERVICE MANUAL (Contains details for making all
recommended repairs and general overhaul of unit)

IMPORTANT!

BE SURE TO INCLUDE COMPLETE MODEL, SPEC., AND SERIAL
NUMBER OF UNIT (SEE ONAN NAMEPLATE)

MODEL AND SPEC. of my unit is _____

SERIAL NUMBER of my unit is _____

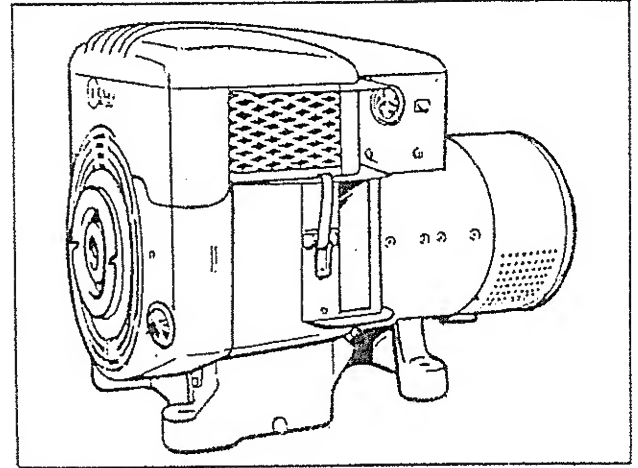
Name _____

St. or R.F.D. _____

City _____ Zone _____ State _____

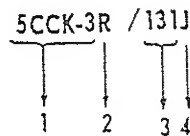
INTRODUCTION

Instructions in this manual may refer to a specific model of generating plant, identify the model by referring to the *MODEL AND SPEC. (specification) NO.* as shown on the plant nameplate. Electrical characteristics are shown on the lower portion of the plant nameplate.



TYPICAL MODEL CCK

How to read MODEL and SPEC. NO.



1. Factory code for general identification.
2. Specific Type:
 - M* - *MANUAL* type. Manually cranked For permanent or portable installations.
 - E* - *ELECTRIC* start type. Electric starting at the plant only.
 - P* - *PORTABLE* type. Pull rope starting. Mounted in carrying frame for portable use.
 - R* - *REMOTE* type. Electric starting. For permanent installation, can be connected to optional accessory equipment for remote or automatic control of starting and stopping.
 - EV* or *RV* - *VACU-FLO* type. Same as *E* or *R*, with reversed (front end duct) cooling air flow.
3. Factory code for optional equipment.
4. Specification (Spec.) letter (advances when factory makes production modifications).

MANUFACTURER'S WARRANTY

The Manufacturer warrants, to the original user, that each product of its manufacture is free from defects in material and factory workmanship if properly installed, serviced and operated under normal conditions according to the Manufacturer's instructions.

Manufacturer's obligation under this warranty is limited to correcting without charge at its factory any part or parts thereof which shall be returned to its factory or one of its Authorized Service Stations, transportation charges prepaid, within one year after being put into service by the original user, and which upon examination shall disclose to the Manufacturer's satisfaction to have been originally defective. Correction of such defects by repair to, or supplying of replacements for defective parts, shall constitute fulfillment of all obligations to original user.

This warranty shall not apply to any of the Manufacturer's products which must be replaced because of normal wear, which have been subject to misuse, negligence or accident or which shall have been repaired or altered outside of the Manufacturer's factory unless authorized by the Manufacturer.

Manufacturer shall not be liable for loss, damage or expense directly or indirectly from the use of its product or from any other cause.

The above warranty supersedes and is in lieu of all other warranties, expressed or implied, and of all other liabilities or obligations on part of Manufacturer. No person, agent or dealer is authorized to give any warranties on behalf of the Manufacturer nor to assume for the Manufacturer any other liability in connection with any of its products unless made in writing and signed by an officer of the Manufacturer.

DATED AUGUST 1, 1963

SPECIFICATIONS

	Model Series			
	4CCK		5CCK	
	M	R	M	R
M : manual start				
R : remote start (electric crank)				
Nominal dimension of plant (inches)				
Height	21	21	21	21
Width	21	21	21	21
Length (3- and 4-wire models, add 1-inch)	26-3/8	26-3/8	30	30
Number cylinders (horizontally opposed)	2	2	2	2
Displacement (cubic inch)	50	50	50	50
Cylinder bore	3-1/4	3-1/4	3-1/4	3-1/4
Piston stroke	3	3	3	3
RPM (for 60-cycle)	1800	1800	1800	1800
RPM (for 50-cycle)	1500	1500	1500	1500
Compression ratio	5.5:1	5.5:1	5.5:1	5.5:1
Ignition (type)				
Battery	No	Yes	No	Yes
Flywheel magneto	Yes	No	Yes	No
Battery voltage (ac plant)	None	12-V	None	12-V
Battery size (ac plant):				
SAE group 1H		two in series		two in series
Amp/hr. SAE rating - 20-hr (nominal)		105		105
Starting by pull rope (recoil) only	Yes	No	Yes	No
Starting by exciter cranking	No	Yes	No	Yes
Starting by starting motor ***	No	No	No	Yes
Battery charge rate amperes	6-Max.	6-Max.	6-Max.	6-Max.
Ventilation Required (cfm 1800 rpm)				
Engine (Pressure Cooling)	500	500	500	500
Engine (Vacu-Flo Cooling)	750	750	750	750
Generator	75	75	75	75
Combustion	32	32	32	32
Output rated at unity power factor load	All	All	All	All
Rating (output in watts)				
*50-cycle AC intermittent service	3500	3500	4250	4250
*50-cycle AC continuous service	3500	3500	4250	4250
**60-cycle AC intermittent service	4000	4000	5000	5000
**60-cycle AC continuous service	3500	3500	5000	5000
AC voltage regulation in \pm %	4	4	5	5
AC frequency regulation in %	5	5	5	5
Revolving armature type generator	Yes	Yes	Yes	Yes
120/240-volt single phase model reconnectible	Yes	Yes	Yes	Yes
Rotating type exciter	Yes	Yes	Yes	Yes

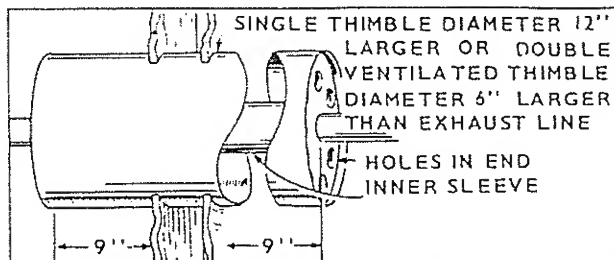
* Basic 50-cycle model

** Basic 60-cycle model

*** Remote model 5CCK-150R only (Magnet Service DC Plant)

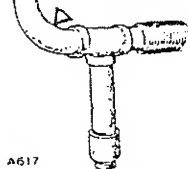
OPTIONAL EQUIPMENT

1. **GAS-GASOLINE CARBURETOR:**
A combination carburetor for burning gasoline fuel or gaseous fuel.
2. **HIGH AIR TEMPERATURE CUTOFF:**
Stops plant if temperature of engine discharged air rises too high. Air shutter mounted on Vacu-flo only.
3. **AIR SHUTTER:**
Thermostatically controlled. Limits air flow when cold to accelerate warm-up. Minimizes cold back drafts when engine is stopped. High air temperature cutoff is standard with air shutter.
4. **SWITCHBOARD:**
Contains instruments to measure ac amperes, ac volts, and to break over-loaded ac circuit. For wall mounting.
5. **AC RECEPTACLES:**
Convenient for plugging in ac loads if needed.
6. **OIL BASE HEATER AND THERMOSTAT:**
Electric heater aids cold starting.
7. **AUTOMATIC DEMAND CONTROL:**
Starts and stops plant automatically when ac load is turned on or off.
8. **LOAD TRANSFER CONTROL:**
Controls running of plant and transfers load when primary ac power is interrupted.
9. **SEPARATE FUEL TANK:**
Various sizes.
10. **OTHER:**
There is a series of other optional items that your dealer will discuss with you. Ask about them.



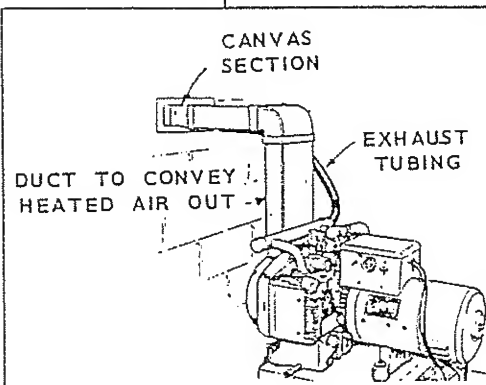
EXHAUST LINE PASSING THROUGH
WALL OR PARTITION

IF EXHAUST LINE MUST BE PITCHED
UPWARD CONSTRUCT A TRAP OF PIPE
FITTINGS AT POINT OF RISE



DRAIN CONDENSATION TRAP
PERIODICALLY

[AVOID SHARP BENDS]



COOLING AIR

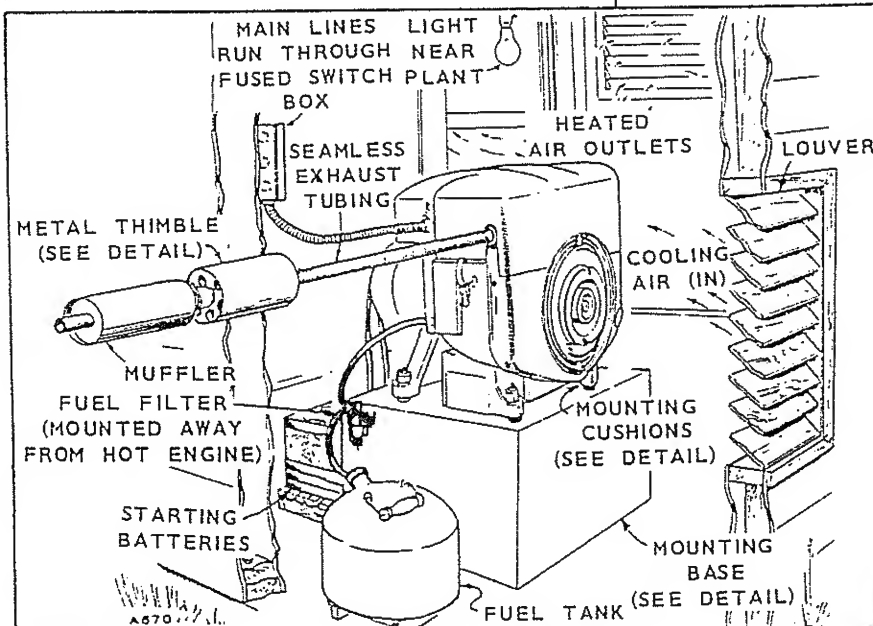
Pressure cooled plants require an air inlet opening and an air outlet of 5 sq. ft. Position the outlet opening above and to the rear of the plant, the inlet opening just opposite the blowerhousing.

VACU-FLO COOLING

Air flow through Vacu-Flo units is reversed. Provide an air inlet of at least 1- sq. ft. Duct the heated air outside. An optional automatic air shutter and air duct is available for use in cold weather.

EXHAUST

Vent exhaust gases outside — EXHAUST GASES ARE DEADLY POISONOUS! Use flexible tubing between the plant exhaust outlet and rigid piping. Shield the line if it passes through a combustible wall or partition. If turns are necessary, use long sweeping type elbows. Use one pipe size larger for each 10-ft. in length. Position the exhaust outlet away from the plant air intake.



LOCATION

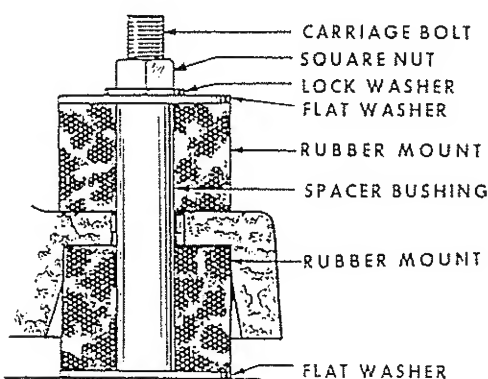
Provide a protected location that is dry, dust-free, and preferably heated in cold weather. For service convenience, provide at least 24" clearance around plant.

OIL DRAIN

For convenience in draining oil, remove the oil drain plug and install an extension pipe and coupling. Oil base has 3/8" pipe tapped hole.

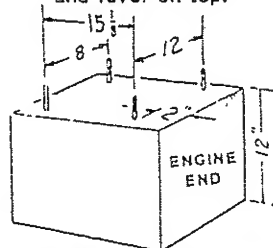
MOBILE INSTALLATIONS

Bolt the plant in place using the mounting cushions. Provide proper ventilation, cooling, service accessibility, etc. Protect against road dust, vibration, and road shock. Follow the principles of installation for a permanent installation. Do not connect to truck engine fuel supply line, provide a separate fuel line to fuel tank. Do not exceed 4 ft. lift from tank bottom to fuel pump.



AB15

Be sure base is smooth
and level on top.



Locate base to allow at least
24" space on all sides.

FIG. 1-1

INSTALLATION

GENERAL

Important installation points are: sufficient cooling, exhaust gas discharge, electrical and fuel connections, location and mounting, and protection from road dust and shocks during transit (mobile applications).

Each installation must be considered individually — use these instructions as a general guide. Always check local building codes, fire ordinances, etc., for compliance. Provide a location that is protected from the weather, dry, dust free, and preferably warm in cold weather. The air discharge side of plant requires only 3" clearance from wall to permit plant to rock on its mounts, at least 24" clearance is required around all other sides for service accessibility.

MOUNTING (See Fig. 1-1)

A permanent type installation needs a sturdy, level, mounting base of concrete, a heavy wood or structural steel at least 12" high to aid oil changing and operating. For mobile applications (trucks or trailers) install slide-out rails or some other means (such as doors) to provide service space. (See Fig. 1-3).

Carefully assemble the mounting cushions, washers and spacer bushing (Fig. 1-1). The spacer bushing prevents compression of the snubber (upper rubber cushion). Space the 3/8" mounting bolts as shown in Fig. 1-1

VENTILATION AND COOLING

Air circulation is needed to dissipate heat produced by the engine and generator in normal operation. *Outdoor* installations can rely on natural circulation, but *mobile, indoor or*

housed installations need proper size and positioned vents for required air flow. See specifications for the air requirements at 1800 rpm.

Vent sizes depend on variable conditions: (1) size of enclosure, (2) ambient temperature, (3) electrical load, (4) running time, (5) restrictions imposed by screens, louvers, shutters, or filters, (6) prevailing wind direction. *Remember that a required volume of air must reach the unit, absorb the heat, and be discharged away from the installation.* Pressure cooled units need an inlet vent with an unrestricted opening of at least 5 sq. ft. for variables. For discharged air, install separate duct from the engine.

1. The engine discharge duct must be the same size as the inlet vent. If a screen is used in the duct, increase the duct size in proportion to the restriction. Consider installing the screen diagonally to limit the restriction and increase duct size for runs over 9-feet. If bends are necessary, use larger radius elbows. Use a canvas section at the plant to absorb vibration (Fig. 1-1). To minimize vapor lock, pitch the duct upward (toward the outlet) so heat can escape when unit is shut down.

Vacu-Flo Cooling Inlet Vent (see specifications for airflow) should be at least 1 sq. ft., the duct for discharged air should be at least as large as the scroll outlet.

Auxiliary fans can be used to increase air flow to units installed in small, poorly ventilated rooms. The fan size and location should be such that the air inlet to the engine

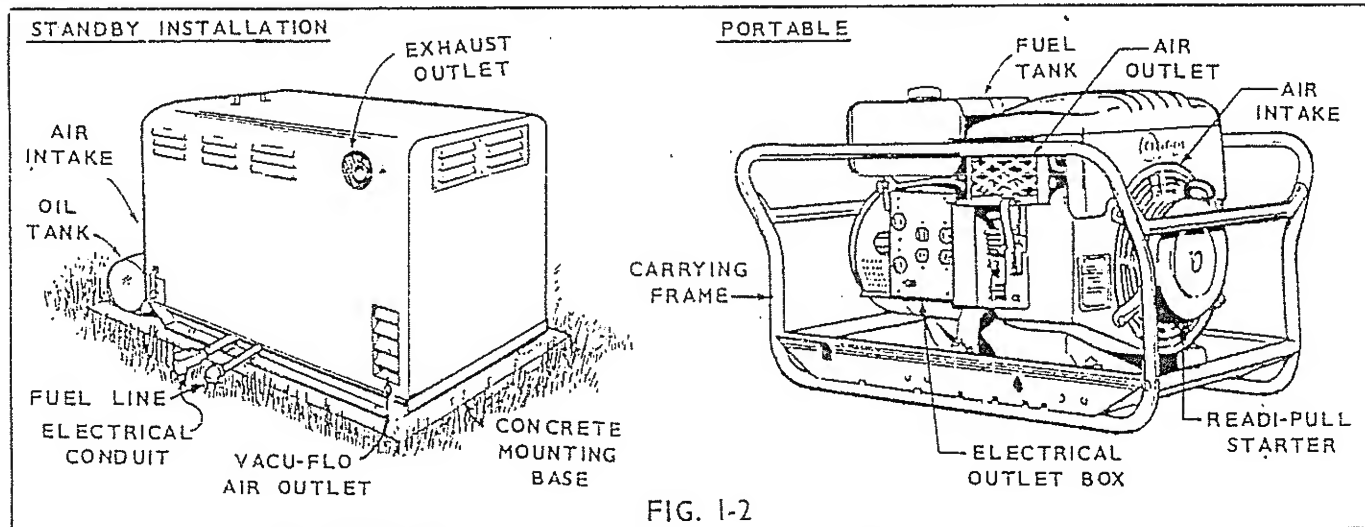


FIG. 1-2

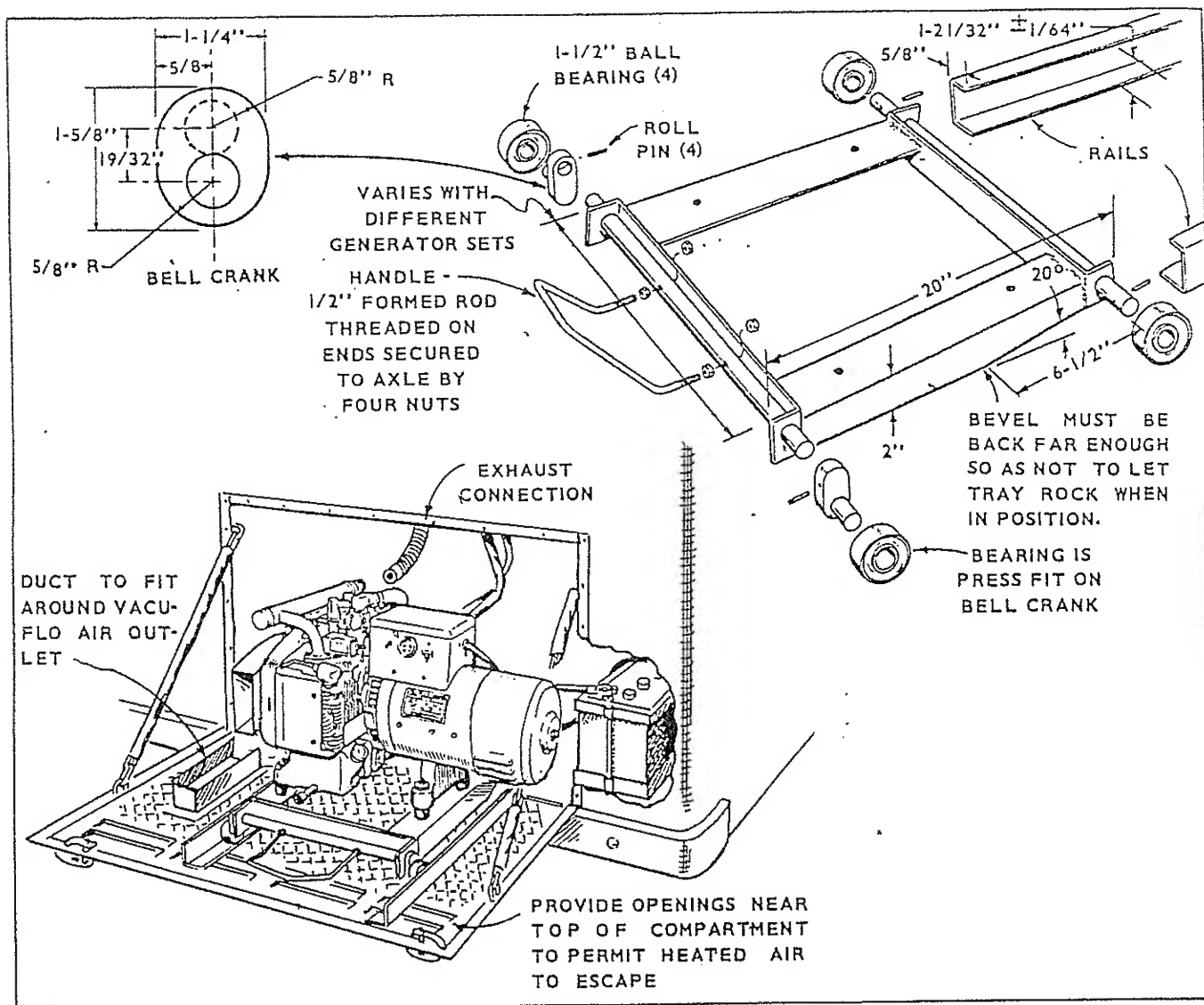


FIG. 1-3

doesn't exceed 120°F when running at full rated load.

Thermostatically controlled shutters can be used to speed warm up after starting and keep cold air out during shut-down. When the discharged air reaches 120°F, shutters begin to open; at 140°F, the shutters are completely open. Air shutters are equipped with a high temperature cut-off switch that stops the plant if duct temperature reaches 240°F \pm 6°. The unit cannot be re-started until the switch temperature drops to 195°F \pm 8°.

GASOLINE TANK

If a separate fuel tank is used, install the tank so the bottom is less than 4-feet below the fuel pump. The tank top must be below fuel pump level to prevent siphoning. Install a shut-off valve at the tank. When the fuel tank is shared with another engine, use a separate fuel line for each to avoid starving the plant.

If fuel lift must exceed 4-feet, install an auxiliary electric fuel pump at the fuel supply. Wire it in parallel with the ignition coil (ahead of resistor). If an auxiliary reservoir fuel tank is used for a *standby* installation, note that fuel

line connections must be changed (Fig. 1-5).

FUEL CONNECTION

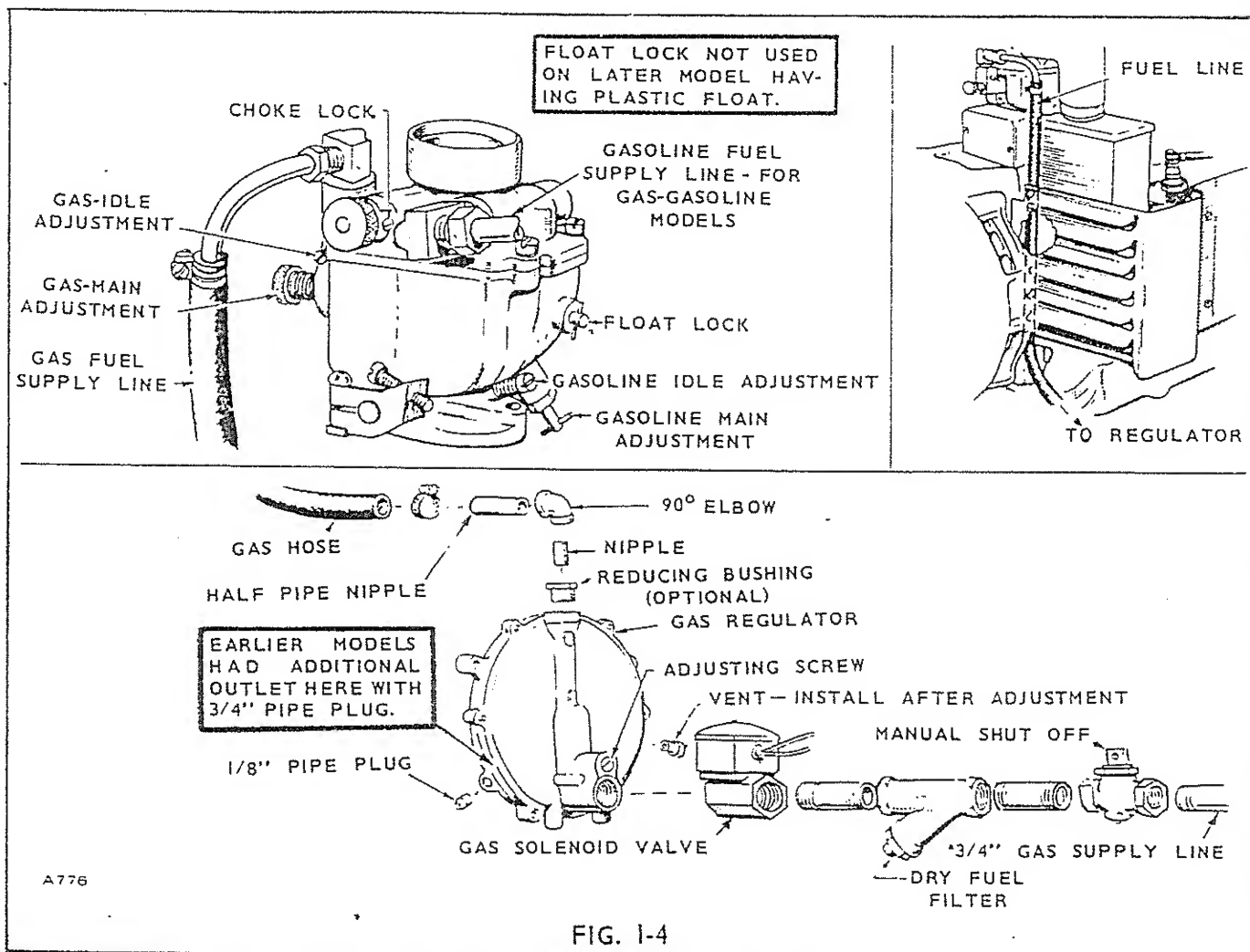
For gasoline plants, connect the fuel line to the fuel pump inlet. Pump is threaded 1/8-27 NPTF (American Standard Internal Tapered Pipe Thread). **Important:** Connect the plant to the fuel source with a flexible line to avoid line failure due to vibration.

For gaseous plants (see Fig. 1-4) check with the local fuel supplier for gas regulations and line pressure. Provide a manual gas valve. A filter in the line may be necessary. Electric solenoid shut-off valves in the supply line are usually required for indoor automatic or remote starting installations. Connect solenoid wires to battery ignition circuit (Fig. 1-4) to open valve during running. Install a demand type gas regulator according to instructions and position it near the plant to aid starting (regulator line pressure must be within 2 to 8 oz.).

Important: Always use flexible tubing between engine and the gas demand regulator.

GROUNDING

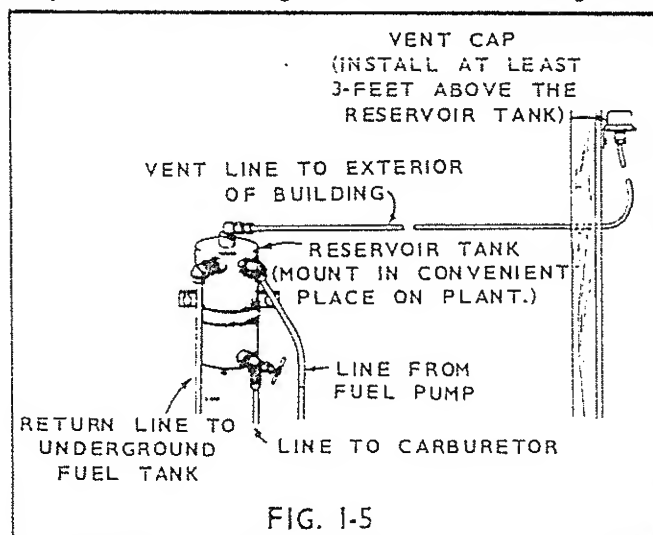
To prevent shock hazard, ground the plant. For permanent installations, connect a #8 or larger wire between:



- (1) a separate ground pipe or rod penetrating into moist earth,
- (2) and the solderless connector located on the generator (on models not so equipped, to the battery ground stud on the engine).

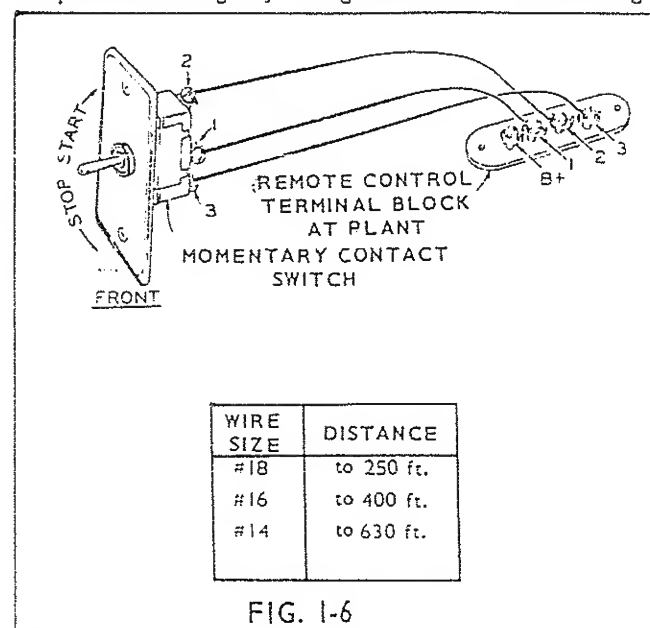
REMOTE START-STOP SWITCH (OPTIONAL)

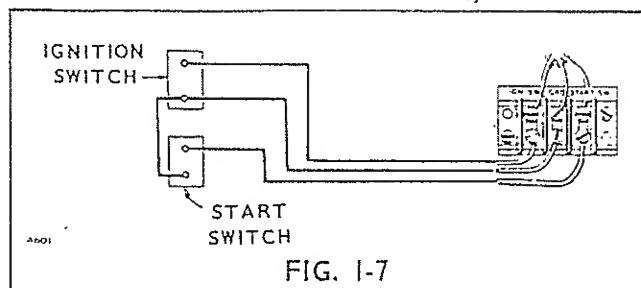
For remote control starting and stopping, use 3-wires to connect the remote switch (SPDT, momentary contact, center-off type) to the terminal block marked B+, 1, 2, 3, in the plant control box using wire sizes as listed in Fig. 1-6.



START AND IGNITION SWITCHES (MAGNET SERVICE PLANTS)

Separate ignition toggle and start push button switches are supplied. These switches can be mounted at any convenient point where the operator will be able to know when the plant starts. Accidental closing of the start switch while the plant is running may damage the starter. Refer to Fig.





1-7 for installation connections.

BATTERY CONNECTION

Plant with Starting Motor: (Magnet Service Plants) See Specifications for minimum 12-volt battery requirements. Connect battery positive (+) to starter engaging solenoid terminal post, Fig. 1-8. Connect battery negative (-) to a good ground on the engine.

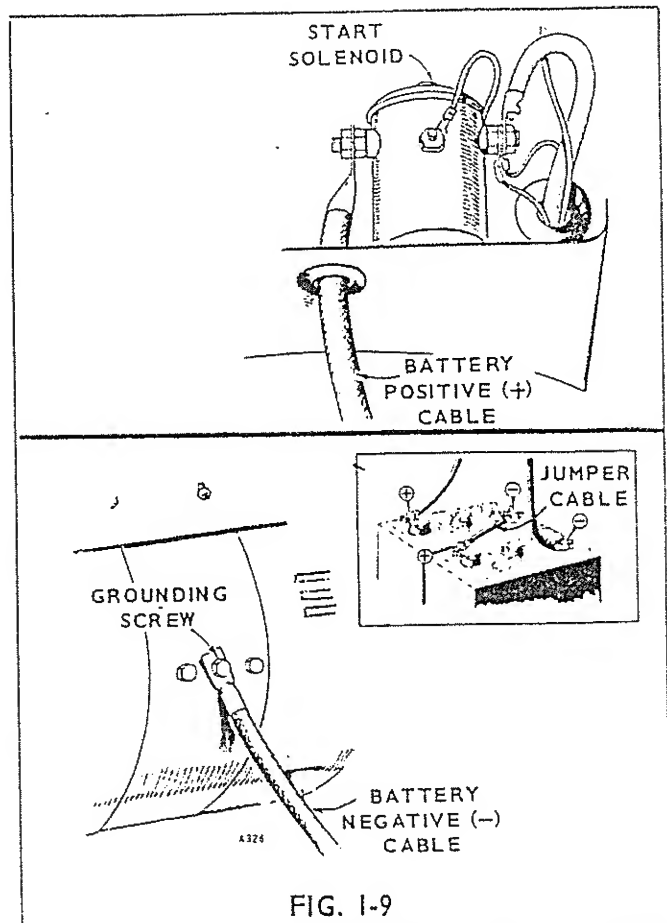
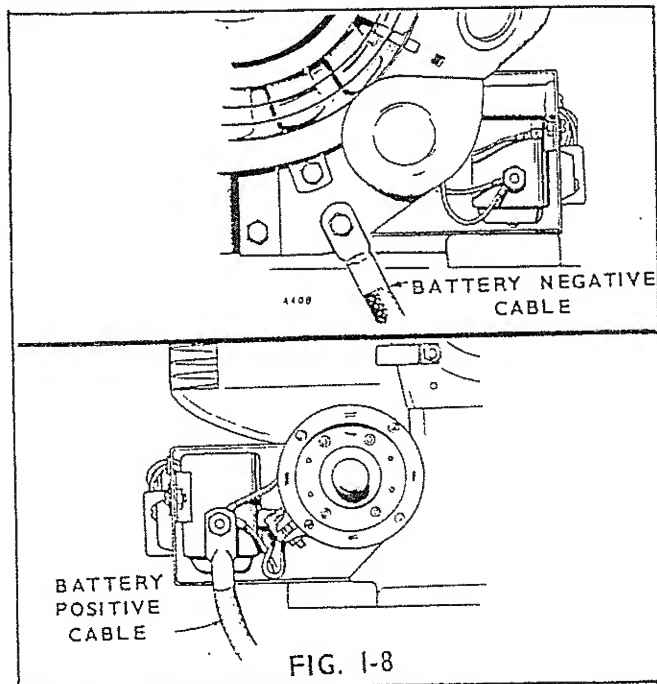
BATTERY CONNECTION

Exciter Cranked Plant: Refer to wiring diagram and Fig. 1-9. If battery ground must be changed, reverse the connections to the charge ammeter or re-mark the correct direction of charge. Crank electrically to flash field.

Provide two 6-volt batteries connected in series (one battery's negative to other battery's positive) for a 12-volt source. See Specifications for minimum battery requirements. Connect the remaining battery positive (+) to the start solenoid (located in the control box). Connect the battery negative (-) to a good ground on the generator.

LOAD WIRE CONNECTIONS

Plant nameplate shows the electrical output rating of the plant in watts, volts, and cycles. The plant wiring diagram shows the electrical circuits and connections necessary for the available output voltage. Also see Fig. 1-10 thru 1-13.

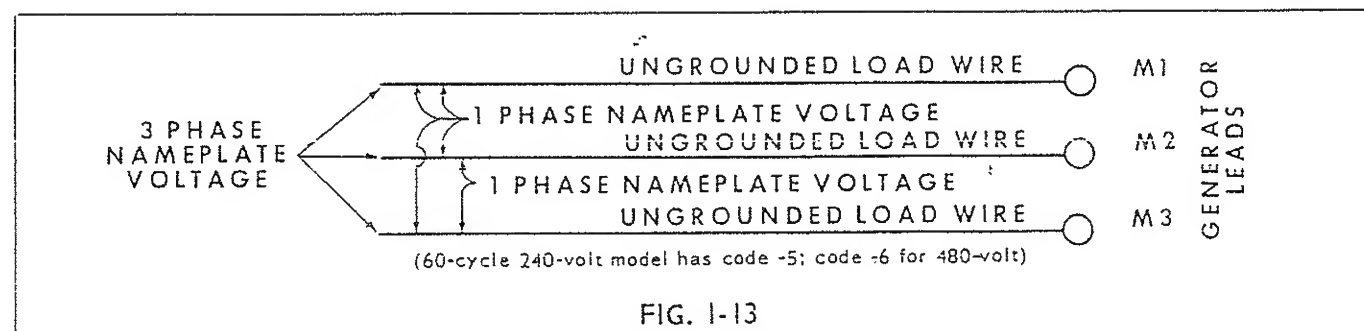
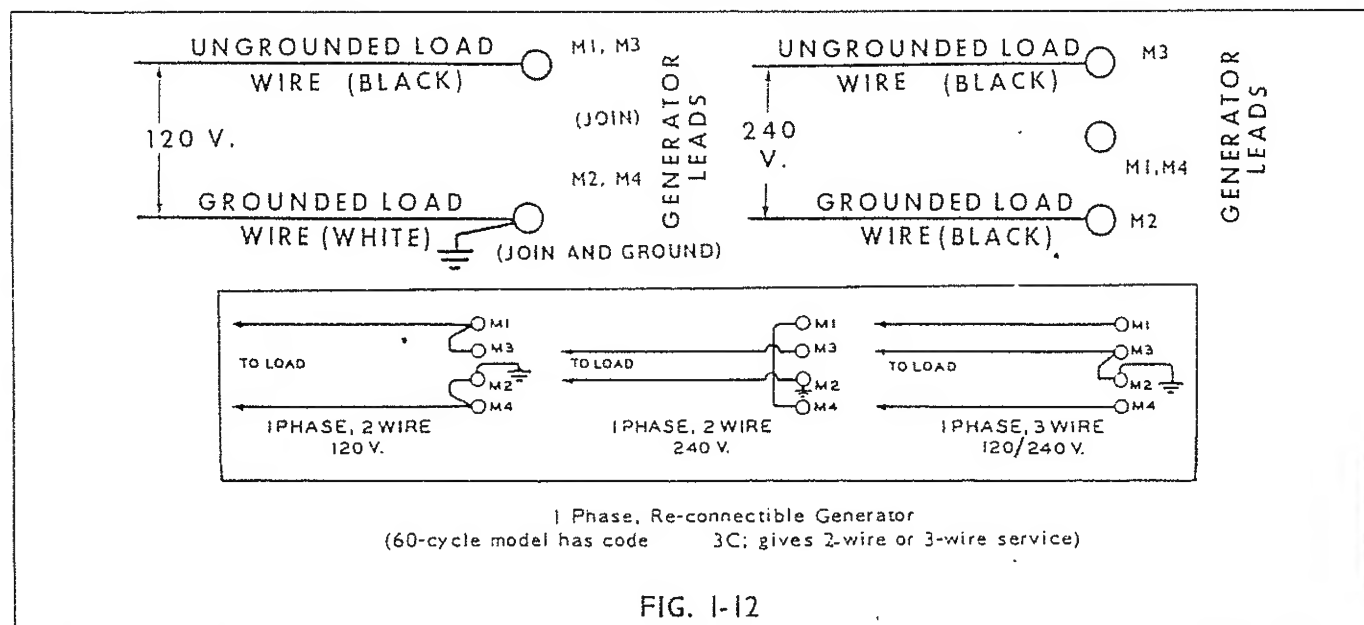
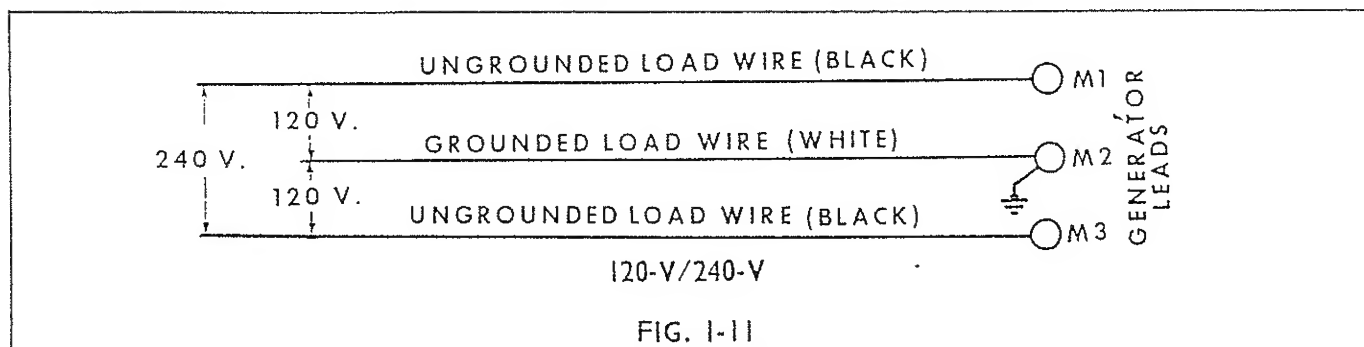
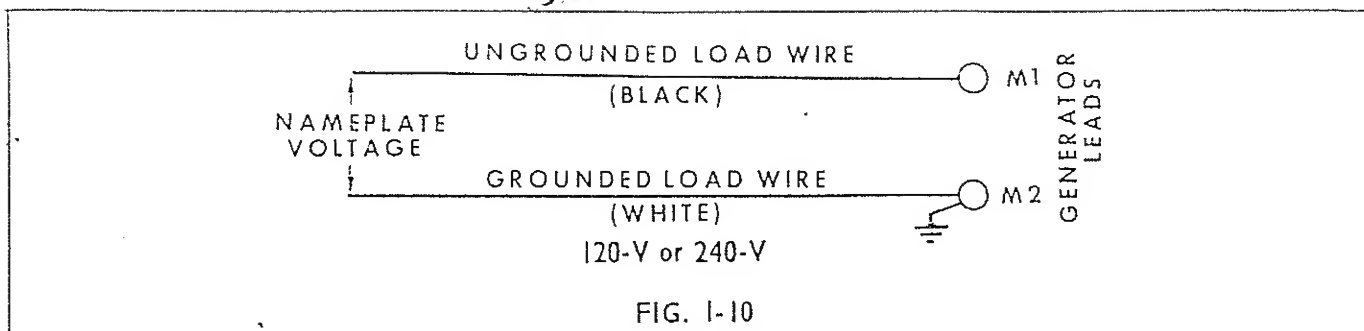


Meet all applicable electrical code requirements. Work should be done by a qualified serviceman or electrician because the installation will be inspected and approved.

The plant control box (junction box) has knock out sections to accommodate load wires. Use flexible conduit and stranded load wires near the plant to absorb vibration. Use sufficiently large insulated wires. Strip insulation from wire ends as necessary for clean connections. Connect each load wire to the proper generator output lead or terminal lug inside the plant box. Insulate bare ends of ungrounded wires. Use a bolt (through the control box) to connect the grounded (\neq) generator lead and load wire. Install a fused main switch (or circuit breaker) between the generating plant and load. If a test-run indicates wrong rotation of 3-phase motors in the load circuit, switch the connections at any two generator terminals.

Standby: If the installation is for standby service, install a double-throw transfer switch (either manual or automatic type) to prevent feeding generator output into the normal power source lines and to also prevent commercial power and generator output from being connected at the same time to the load. Instructions for connecting an automatic load transfer switch is included with such equipment. See Fig. 1-1.

Balancing the Load: Current for any one output lead must not exceed nameplate rating. Serious overloading can damage the generator windings. When two or more single phase circuits are available, divide the load equally between



them. To determine the amount of current available on each single phase circuit, subtract the higher voltage load or 3-phase load (whichever applies) from the rated output and divide the remainder by the quantity of single phase circuits. **EXAMPLE:** On a 5,000-watt, 3-phase, 4-wire plant, if 2,000-watts of 3-phase is used....a remainder of 3,000-watts is available to be equally divided between the three single phase circuits.

Output Lead Markings: Revolving armature generator leads are marked M1, M2, etc. These identifying marks also appear on the wiring diagram.

Voltage Selection on Reconnectible Single Phase Generators: Models 4CCK-3CR and 5CCK-3CR are reconnectible for use as 120/240-volt 3-wire, 120-volt 2-wire, or 240-volt 2-wire, or 240-volt 3-wire power source (Fig. I-12). Use the con-

nection for two wire service when one load exceeds 1/2 the rated capacity. Balance the load when connected for three-wire service.

Load Connections: Refer to the figure which illustrates the load connection for the output shown on your plant's nameplate. See switchboard instructions here when a switchboard is used.

Load Connections: (Magnet Service) The magnet service plant, has generator leads marked A1, F2, and A2 extending into the outlet box. Connect the voltage control rheostat

between leads F2 and A2. Connect the magnet (load) wires to generator leads A1 and A2.

Switchboard: When an optional wall mounted switchboard containing ammeters, voltmeters, circuit breakers, is used, these load wire connections apply: Connect to the unused terminal of each ammeter, one ungrounded (hot) generator lead. Connect to the ground stud in the switchboard, generator leads and load wires which are to be grounded - if any. Connect to the unused terminal of each circuit breaker, one ungrounded (hot) load wire. On plants which generate more than one voltage, the voltmeter reads the higher voltage shown on the nameplate. The lower voltage is correct when the higher voltage is correct.

OPERATION

INITIAL START

Check the engine to make sure it has been filled with oil and fuel. If engine fails to start at first attempt, inhibitor oil used at the factory may have fouled the spark plugs — remove, clean in gasoline, dry thoroughly and install. Heavy exhaust smoke when the engine is first started is normal and is caused by the inhibitor oil.

Crankcase Oil: Use a good-quality heavy-duty detergent oil that meets the API (American Petroleum Institute) service designations MS, MS/DG. Recommended SAE oil numbers for expected ambient temperatures are as follows:

Above 90°F	SAE 50
30°F to 90°F	SAE 30
0°F to 30°F	SAE 10W
Below 0°F	SAE 5W-20

Do not use service DS oil. Do not mix brands or grades. Refer to Maintenance Section for recommended oil changes and complete lubricating oil recommendations.

Recommended Fuel: Use clean, fresh, *regular* grade, automotive gasoline. Do not use highly leaded *premium* types. Never fill the tank when the engine is running and leave some fuel expansion space. Open fuel line valve (when used).

ELECTRIC STARTING

Remote Control, AC Plant: Push the *start-stop* switch to its *start* position. Release the switch as soon as the plant starts.

Magnet Service Plant: Set the *ignition* switch to its on position. Push the *start* switch to crank the engine.

Release the start switch as soon as the plant starts.

MANUAL STARTING

Manual or Portable Type Plant: Adjust the manual carburetor choke as necessary for the temperature conditions. Pull the start rope with a fast, steady pull to crank the engine. Do not jerk. As the plant warms up, adjust the choke gradually to its fully open position.

Remote Control, AC Plant: If the battery charge condition is too low to crank the engine, but is sufficient to supply ignition current, the plant can be started manually. Set the

control box switch to its *manual* start position. Pull the rope with a fast, steady pull to crank the engine. Do not jerk. After starting, return the control box switch to the *electric start* position, to avoid discharging the battery.

APPLYING LOAD

If practicable, allow plant to warm up before connecting a heavy load. Continuous generator overloading may cause high operating temperatures that can damage the windings. Keep the load within nameplate rating.

RHEOSTAT CONTROL, MAGNET SERVICE

Be sure the field rheostat is turned to its maximum resistance position (minimum generator voltage) before starting the plant. After connecting the magnet by operating the magnet controller, adjust the rheostat to give a generator voltage of 250-volts, or to the rated voltage of the magnet. When first connected, the magnet resistance is comparatively low, so more rheostat resistance is needed to keep the voltage at the proper value. As the magnet warms up in use, the rheostat must be readjusted to bring the voltage up to normal.

BATTERY CHARGING

The battery charge rate is automatically controlled by a voltage regulator. On AC plants, the high charge rate was set at the factory for average operating conditions. If frequent starts and short operating periods require an increased high charge rate, adjust by moving the slide clip on the adjustable resistor in the control box. On plants with a separate charging generator, failure of charge current could be due to a blown fuse in the voltage regulator.

DUAL PURPOSE PLANT:

The charging rate to the battery is controlled by a *Hi-Lo* charge switch located near the ammeter on the plant control box. When this switch is at the *Hi* position, the charging rate is about 20 amperes. When the switch is at the *Lo* position, the charging rate is about 3 amperes.

The total ac load on the dual purpose plant should not exceed 2250-watts when the charge switch is at the *Hi* position. When the charge switch is at the *Lo* position, the full ac capacity of 3,000-watts can be used.

The plant produces alternating current (ac) as well as direct

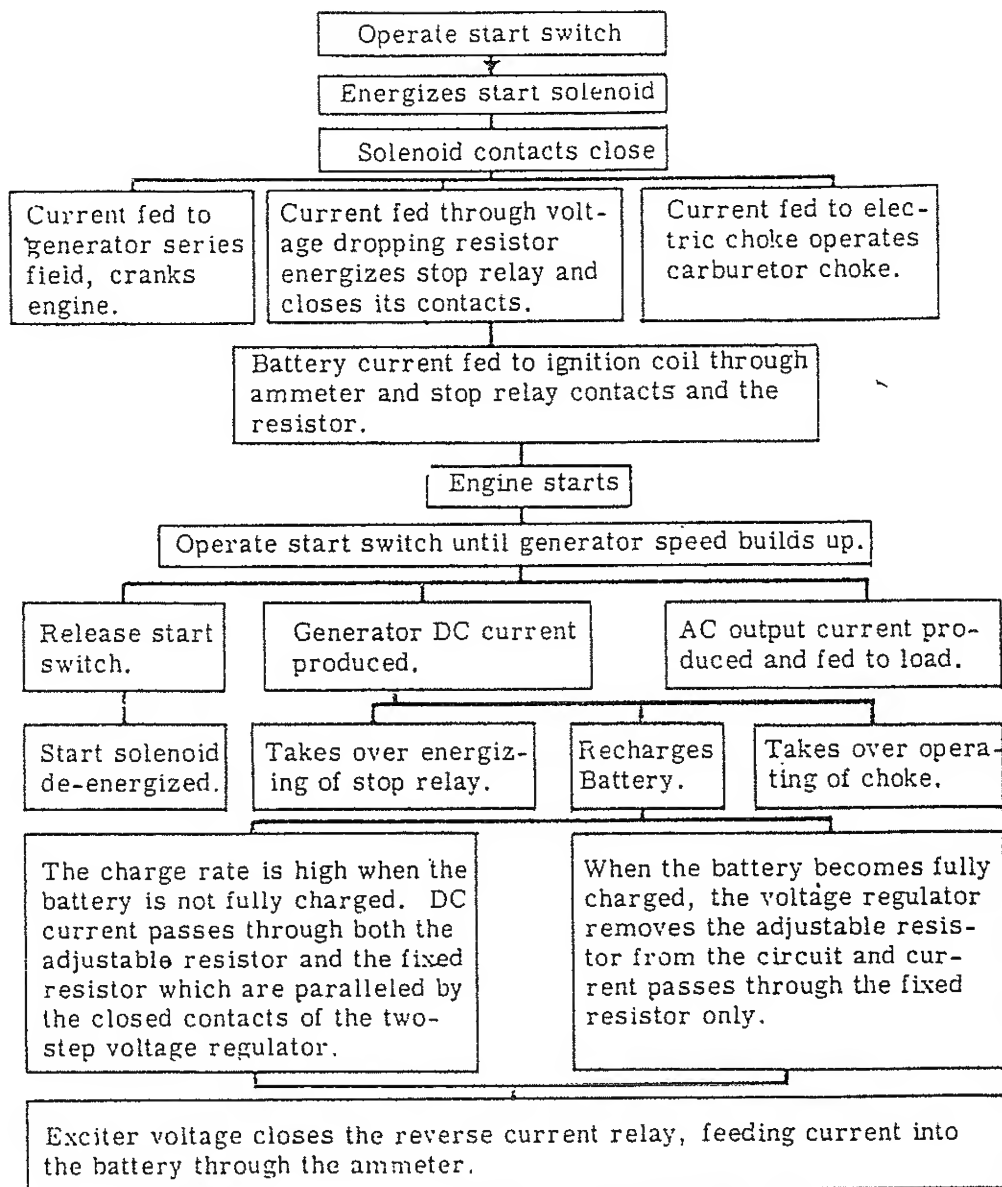


FIG. 2-1

current (dc) and must operate at about 1800 rpm (for 60 cycle plants) in order to produce the correct frequency. *Never increase engine speed to increase the charging rate.* Engine speed should be adjusted only as necessary to obtain the correct ac output frequency.

GAS-GASOLINE CONVERSION

Engines having a combination gas-gasoline carburetor can be switched to gasoline operation by the following procedure: (1) Close the manual fuel shut-off valve in supply line for natural gas or Propane-Butane vapor, wherever located; (2) Open the gasoline fuel shut-off valve, wherever located; (3) Unscrew the carburetor float lock (early models only) all the way outward to backseat (necessary to prevent

leakage); (4) Set the spark plug gap as given in the Table of Clearances; (5) See that the choke is free and works easily (be sure to release choke lock on plants with electric choke); (6) Start the engine in the manner described for the engine. If the engine runs unevenly under half or full load, due to faulty carburetor adjustment, the main jet needs adjusting. This is not the same main adjusting screw used for gaseous fuel. Another adjusting screw is provided for this purpose (refer to Adjustment Section).

To change back to natural or Propane-Butane operation, reverse the above procedure and reset the spark plug gap.

PLANT EXERCISE

Infrequent use results in hard starting. Operate plant one

30-minute period each week. Run longer if battery needs charging.

EMERGENCY OPERATION IF BATTERY FAILS

The remote-type revolving-armature plant needs a battery for electric choke and ignition. If the battery fails completely and the plant must be operated during an emergency, a battery can be shared with other equipment provided the plant charging circuit is disconnected as follows: Remove the wire which connects to the battery terminal on the reverse current relay from the ammeter and tape the bare end. With this lead disconnected, the plant will not recharge battery.

BREAK-IN PROCEDURE

No matter how carefully engine parts are manufactured or expertly assembled, there are always microscopic variations in fit between metal parts such as pistons, rings, main and connecting rod bearings.

Break-in or ideal fitting of all internal moving metal parts can best be achieved by maintaining proper cooling and correct lubrication during the running-in period. *Break-in* can take as little as ten operating hours or it may take many hundreds of hours. Extended periods of very heavy engine loading (above rated horsepower or electrical output) during this initial service period can cause severe cylinder scoring or bearing galling. On the other hand extended periods of very light loading during initial break-in may cause cylinder wall glazing and/or poor piston ring seating. Engine parts damage can also be caused by using the wrong type and viscosity oil and high engine operating temperatures during break-in.

All engines use more oil than normal during the first hours of operation. As internal moving parts are run-in by controlled operation, oil consumption should gradually decrease until the rate of consumption is stabilized. It is extremely rare that oil consumption drops to zero. All engines use some oil even when in perfect condition and properly broken-in. Oil consumption varies according to engine design, engine (piston) speed, size of engine, type of oil, oil viscosity, length of operating periods, operating temperatures, engine loading, etc. As engine operation is continued, clearance between moving parts increase slightly due to normal wear of piston rings, cylinder walls, valve guides, oil seals, etc. These clearances increase until oil consumption is excessive and engine parts have to be replaced and/or refitted. This usually takes thousands of hours.

Each Onan engine is *run-in* at the Onan factory for a minimum of three hours. This is not enough running time to completely *break-in* the engine. Proper completion of the *break-in* period is up to the customer.

Generator sets manufactured by Onan can be loaded to full nameplate rated output (not until they *bog down*) as soon as they are put into operation. It is recommended during these first few hours of operation that generator sets be loaded to 80% of rated capacity. Initial heavy loading helps seat

piston rings and brings oil consumption to normal in the shortest time.

During *break-in* check oil level at least every eight (8) operational hours. Add oil if the level is at *low* on the dipstick. Never over-fill. This may cause oil to foam and enter the breather system.

Drain the initial oil fill after 50-hours of operation while the engine is hot.

Controlled *break-in* with consistent use of proper oil from a reputable supplier and a conscientiously applied maintenance program will help assure satisfactory service for thousands of hours from your Onan electric plant.

OUT-OF-SERVICE PROTECTION

Protect a plant that is to be out-of-service for more than 30 days as follows:

1. Run plant until thoroughly warm.
2. Turn off fuel supply and run until plant stops.
3. Drain oil from oil base while still warm. Refill and attach a warning tag stating oil viscosity used.
4. Remove each spark plug. Pour 1 oz. (two tablespoons) of rust inhibitor (or SAE #50 oil) into each cylinder. Crank engine slowly (by hand) several times. Install spark plugs.
5. Service air cleaner.
6. Clean governor linkage and protect by wrapping with a clean cloth.
7. Plug exhaust outlet to prevent entrance of moisture, dirt, bugs, etc.
8. Wipe generator brushes, slip rings, etc. Do not apply lubricant or preservative.
9. Wipe entire unit. Coat rustable parts with a light film of grease or oil.
10. Provide a suitable cover for the entire unit.
11. If battery is used, disconnect and follow standard battery storage procedure.

HIGH TEMPERATURES

1. See that nothing obstructs air flow to-and-from the plant.
2. Keep cooling fins clean. Air housing should be properly installed and undamaged.
3. Keep ignition timing properly adjusted.

LOW TEMPERATURES

1. Use correct SAE No. oil for temperature conditions. Change oil only when engine is warm. If an unexpected temperature drop causes an emergency, move the plant to a warm location or apply heat externally until oil flows freely.
2. Use fresh (not *premium*) gasoline. Protect against moisture condensation. Below 60°F adjust carburetor main jet for slightly richer fuel mixture.
3. Keep ignition system clean, properly adjusted, and batteries in a well charged condition.
4. Partially restrict cool air flow but use care to avoid overheating.

DUST AND DIRT

1. Keep plant clean. Keep cooling surfaces clean.
2. Service air cleaner as frequently as necessary.
3. Change crankcase oil every 100 operating hours.
4. Keep oil and gasoline in dust-tight containers.
5. Keep governor linkage clean.
6. Clean generator brushes, slip rings, and commutator - do not remove normal (dark brown) film. Do not polish.

HIGH ALTITUDE

For operation at altitudes of 2500-feet above sea level, close carburetor main jet adjustment slightly to maintain proper air-to-fuel ratio (refer to the *Adjustments Section*). Maximum power will be reduced approximately 4% for each 1000-feet above sea level, after the first 1000-feet.

ADJUSTMENTS

CHECK BREAKER POINTS

Refer to Maintenance Schedule for correct gap distances. Replace burned or faulty points. If only slightly burned, dress smooth with file or fine stone. Measure gap with thickness gage, gap points at .020".

Ignition breaker points, Fig. 3-1 must be correctly gapped. Crank engine to fully open breaker points (1/4 turn after top center). Loosen and move stationary contact to correct the gap at full point separation. Secure points and check for correct gap.

Ignition points should break contact just when the timing mark aligns with the flywheel timing mark (19° for 1500 to 2400 rpm, 25° for 2500 rpm plants). Final timing is corrected by properly shifting the breaker point box on its mounting and using a timing light. If specified timing cannot be obtained by positioning the breaker box, check to be sure the

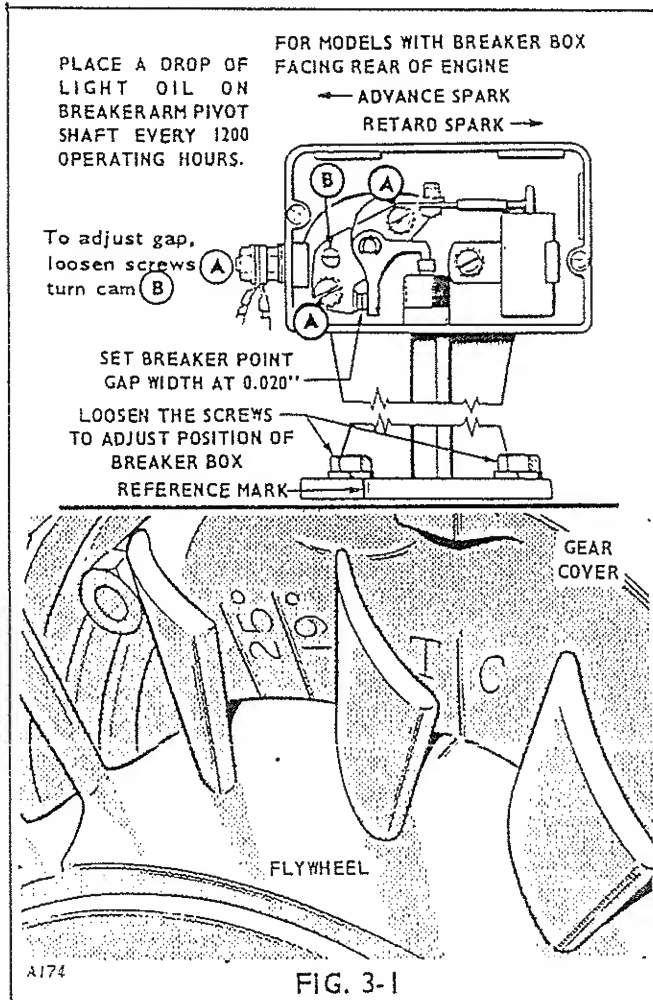


FIG. 3-1

timing marks on gears are aligned. Timing procedures appear in separate service manual.

CARBURETOR

Gasoline: If the carburetor is completely out of adjustment, turn the idle adjustment, and main adjustment, needles in gently to their seats. Do not force them in, they will be damaged by seating tightly. A J type wrench is available for easy access to adjust the main adjustment needle (Fig. 3-2).

1. Back the idle needle out about one turn, the main needle out about two turns, to permit starting the plant.

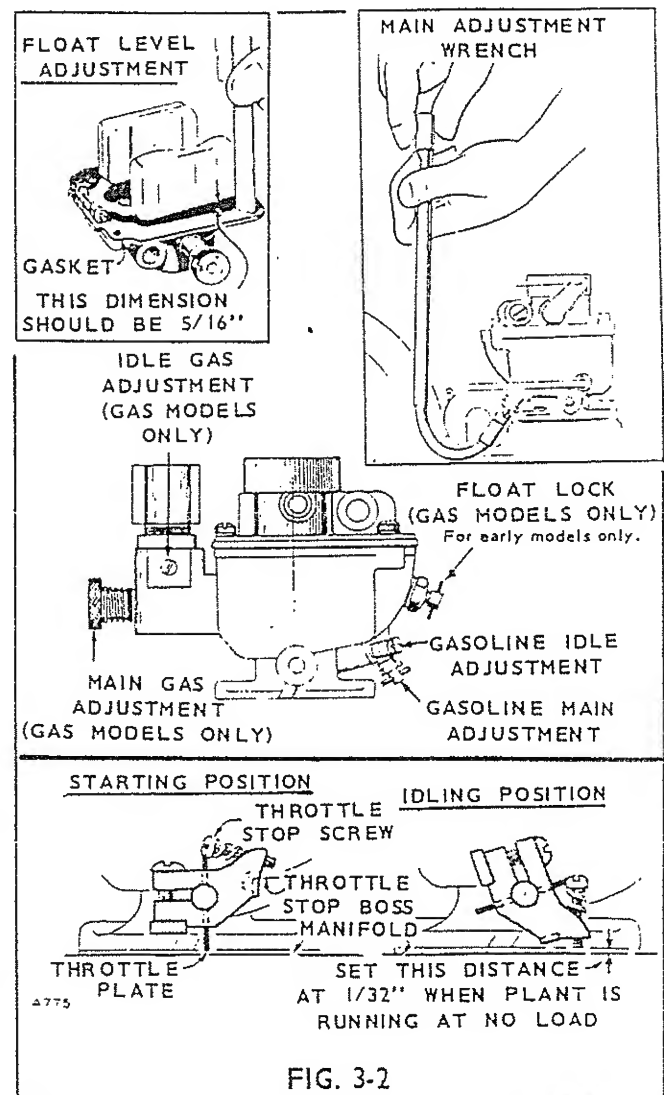


FIG. 3-2

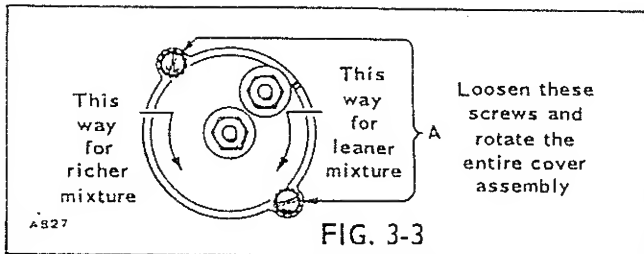


FIG. 3-3

2. Start the plant and allow it to thoroughly warm up.
3. With a full rated load connected, turn the main needle in slowly until the plant begins to lose speed, or the voltage drops. Turn the needle out to the point where the plant will carry the full load.
4. Check the operation at various loads. If there is any tendency to alternately increase and decrease speed,

turn the main needle out just to a point where the operation is steady. Do not turn out more than 1/2 turn past the point of smooth full load operation. Continued unstable operation may be due to improper governor adjustment.

5. Make final adjustment of idle needle with no load connected. Turn the idle needle in slowly until the plant loses speed. Turn the needle out to the point of smooth operation.
6. The throttle idle stop screw should be adjusted to clear the manifold by 1/32" when plant is operating at desired speed and no load condition.

Gas Fuel: When operating on gas fuel, follow the procedure given for gasoline fuel, using the gas fuel adjusting screws.

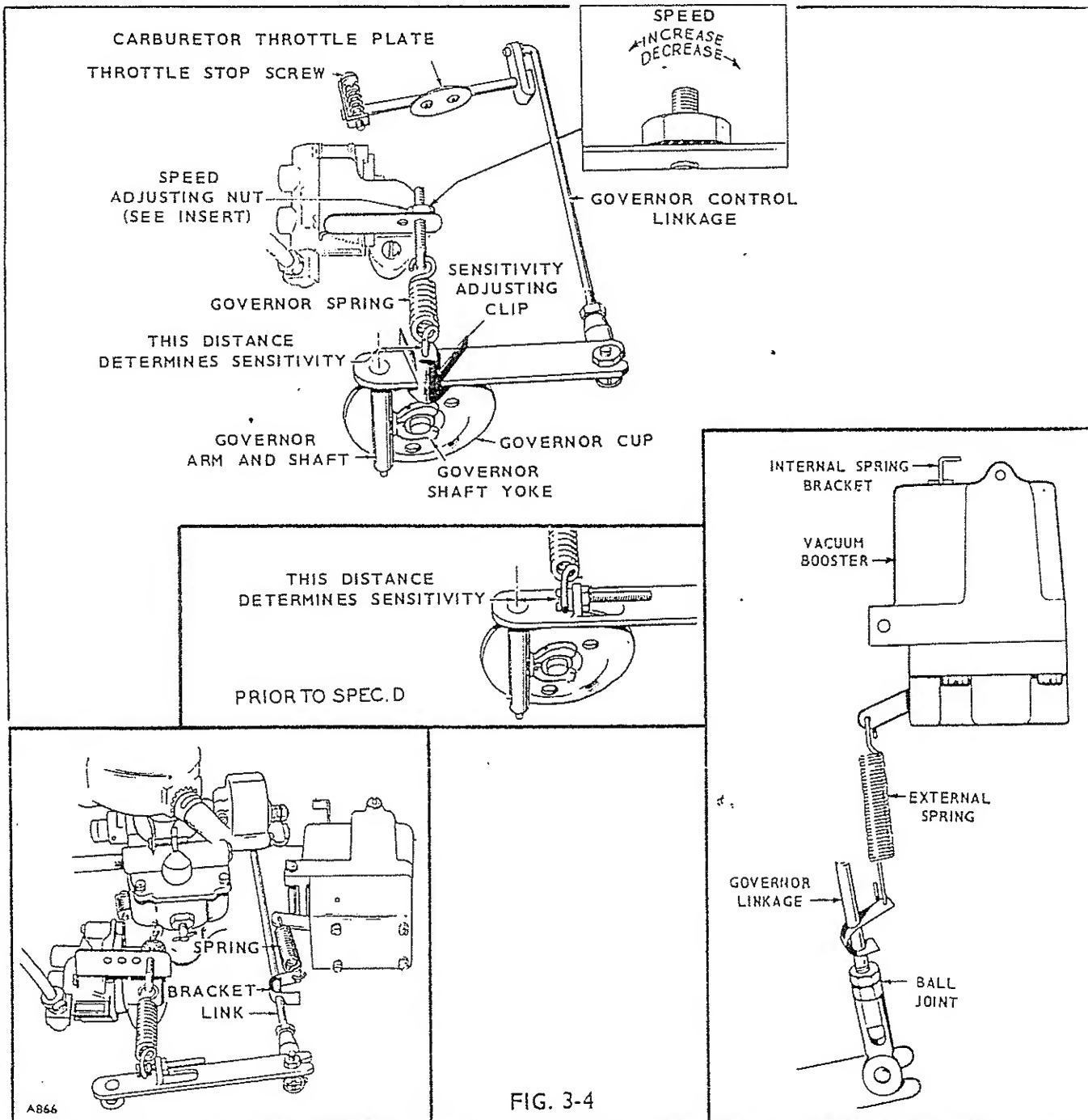


FIG. 3-4

Always be sure the carburetor choke is locked in its wide open position.

ELECTRIC CHOKE

If extremes in starting temperatures require a readjustment of the choke, loosen slightly the two cover retaining screws. For less choking action, turn the cover assembly a few degrees in a clockwise direction. For more choking action, turn counterclockwise. Retighten the cover screws.

GOVERNOR AND BOOSTER

The governor and booster control the speed of the engine. A speed adjustment includes adjusting both devices (Fig. 3-4).

GOVERNOR

Before making final governor adjustments, run the plant about 15-minutes under light load to reach normal operating temperature. (If governor is completely out of adjustment, make a preliminary adjustment at no load to first attain a safe voltage operating range).

On ac generating plants, engine speed determines the output voltage and current frequency of the generator. By increasing the engine speed, generator voltage and frequency are increased, and by decreasing the engine speed, generator voltage and frequency are decreased. An accurate voltmeter or frequency meter (preferable both) should be connected to the generator output in order to correctly adjust the governor of the ac plant. A small speed drop not noticeable without instruments will result in an objectionable voltage drop. The engine speed can be checked with a tachometer.

A binding in the bearings of the governor shaft, in the ball joint, or in the carburetor throttle assembly will cause erratic governor action or alternate increase and decrease in speed (hunting). A lean carburetor adjustment may also cause hunting. Springs of all kinds have a tendency to lose their calibrated tension through fatigue after long usage. If all governor and carburetor adjustments are properly made, and the governor action is still erratic, replacing the spring with a new one and resetting the adjustments will usually correct the trouble.

1. Adjust the carburetor main jet for the best fuel mixture while operating the plant with a full rated load connected.
2. Adjust the carburetor idle needle with no load connected.
3. Adjust the length of the governor linkage and check linkage and throttle shaft for binding or excessive looseness.
4. Adjust the governor spring tension for rated speed at no load operation with booster disconnected (or held inoperative).
5. Adjust the governor sensitivity.
6. Recheck the speed adjustment.
7. Set the carburetor throttle stop screw.
8. Set the vacuum speed-booster.

VOLTAGE CHART FOR CHECKING GOVERNOR REGULATION

ALTERNATING CURRENT TYPES OF PLANTS	120-VOLT 1-PHASE 2-WIRE OR 120/240-V 1-PHASE 3-WIRE	240-VOLT 1-PHASE 2-WIRE OR 240-VOLT 3-PHASE 3-WIRE
NOTE: Output rating is at UNITY power factor load.		
Maximum No Load Volts	126	252
Minimum Full Load Volts Without Booster	110	220
Maximum Voltage Drop from No Load Operation to Full Load Operation	16	32
Preferred Voltage Regulation, No Load to Full Load Oper- ation	122-118	244-236
Preferred Voltage Spread	5	9

SPEED CHART FOR CHECKING GOVERNOR REGULATION

ALTERNATING CURRENT TYPES OF PLANTS	FOR ALL 60-CYCLE PLANTS	FOR ALL 50-CYCLE PLANTS
Maximum No Load Speed RPM	1920	1620
Cycles (Current Frequency)	64	54
Minimum Full Load Speed Without Booster RPM	1710	1500
Cycles	57	50
Maximum Speed Drop from No Load Operation to Full Load Operation RPM	90	90
Cycles	3	3
Preferred Speed Regulation, No Load to Full Load Operation RPM	1830-1770	1590-1530
Cycles	61-59	53-51
Preferred Speed Spread RPM	60	60
Cycles	2	2

VOLTAGE CHART FOR CHECKING GOVERNOR REGULATION

DIRECT CURRENT TYPES OF PLANTS	115 VOLT DC	250 VOLT DC MAGNET SERVICE
Maximum No Load Volts	120	270
Minimum Full Load Volts Without Booster	110	240
Maximum Voltage Drop from No Load to Full Load	10	30
Preferred Voltage Regulation, No Load to Full Load	120-110	265-245
Preferred Voltage Spread	—	20

SPEED CHART FOR CHECKING GOVERNOR REGULATION

DIRECT CURRENT TYPES OF PLANTS	115 VOLT DC	250 VOLT DC MAGNET SERVICE
Maximum No Load Speed RPM (Revolutions Per Minute)	2000*	2000**
Minimum Full Load Speed Without Booster RPM	1800*	1800**
Maximum Speed Drop from No Load Operation to Full Load Operation RPM	200	200

Note * - For models prior to Spec D, speed is 2400-2700 rpm.

Note** - For Models prior to Spec D, speed is 2500-2750 rpm.

LINKAGE

The engine starts at wide open throttle. The length of the linkage connecting the governor arm to the throttle shaft and lever is adjusted by rotating the ball joint. Adjust this length so that with the engine stopped and tension on the governor spring, the stop on the carburetor throttle lever just contacts the underside of the carburetor bowl. This setting allows immediate control by the governor after starting. It also synchronizes travel of the governor arm and the throttle shaft.

SPEED ADJUSTMENT

With the warmed-up plant operating at no load, and with the booster external spring disconnected (or otherwise held inactive), adjust the tension of the governor spring. Refer

to Voltage Chart and the Speed Chart, and select the column which corresponds to the nameplate of the plant in question. Turn the speed adjusting nut to obtain a voltage and speed reading within the limits shown.

SENSITIVITY ADJUSTMENT

Refer to the Governor Adjustment illustration, and to the Voltage and Speed Charts. Check the voltage and speed, first with no load connected and again with a full load. Adjust the sensitivity so as to give the closest regulation (least speed and voltage difference between no load and full load) without causing a hunting condition.

To increase sensitivity (closer regulation), shift the adjusting clip toward the governor shaft. On earlier models prior to spec D, turn the adjusting stud counterclockwise. An adjustment for too much sensitivity will cause alternating increase and decrease of engine speed (hunting).

To decrease sensitivity, shift the adjusting clip toward the outer end of the governor arm. On earlier models, turn the adjusting stud clockwise. Too little sensitivity will result in too much difference in speed between no load and full load conditions.

Any change in the sensitivity adjustment usually requires a compensating speed (spring tension) adjustment.

SPEED-BOOSTER

After satisfactory performance under various loads has been attained by governor adjustments without the booster, the booster can be connected. Connect the booster external spring to the bracket on the governor link (rod). With the plant operating at no load, slide the bracket on the governor link just to the position where there is no tension on the external spring (Fig. 3-4).

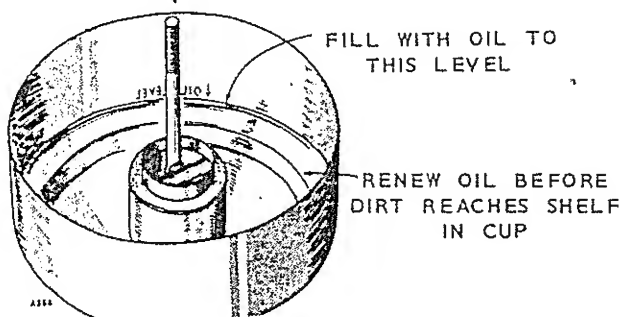
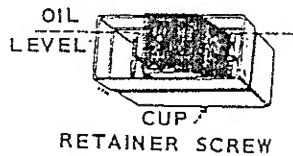
Apply a full rated electrical load to the generator. The output voltage should stabilize at nearly the same reading for full load as for no load operation. The speed may remain about the same or increase when the load is applied, resulting in a frequency 1 or 2-cycles *higher than* the no load frequency. (1-cycle is equal to 30 rpm for a 4-pole generator). If the rise in frequency is more than 2-cycles, lessen the internal spring tension. If there is a drop in the frequency, increase the booster internal spring tension. To increase the tension, pull out on the spring bracket, and move the pin to a different hole.

With the booster disconnected, a maximum drop of 3-cycles from no load to full load is normal. With the booster in operation, a maximum *increase* of 2-cycles from no load to full load is normal. A drop of 1-cycle at 1/4 load is permissible, giving an over all spread of 3-cycles, maximum.

The effect of the booster is limited by the general condition of the engine. The booster cannot compensate for a loss in engine vacuum caused by leaky valves, worn piston rings, etc.

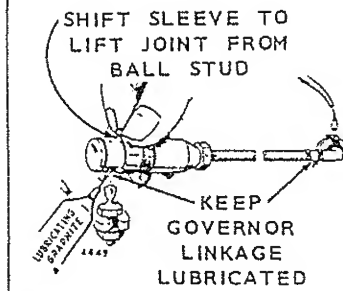
MAINTENANCE

PERFORM ALL MAINTENANCE DETAILS AS SPECIFIED IN THE MAINTENANCE SCHEDULE

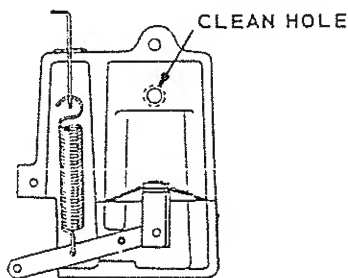


AIR CLEANER

Fill to level indicated on cup. Use the same type of oil as used in crankcase.



GOVERNOR LINKAGE

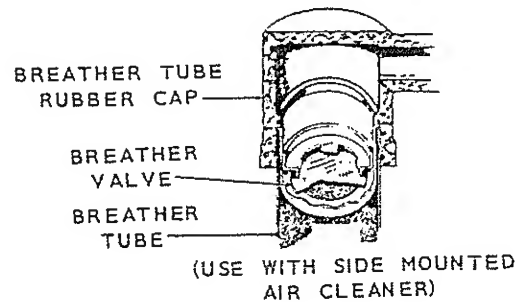
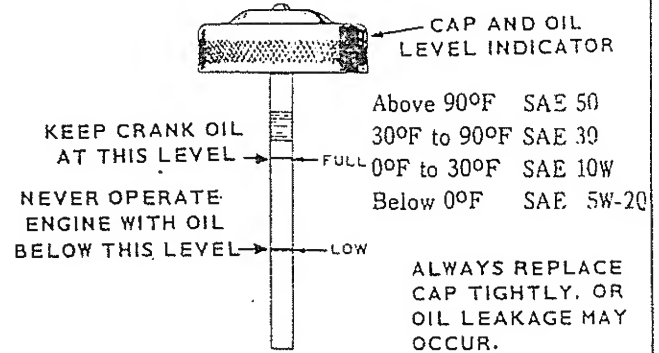


SPEED BOOSTER

Use a fine wire to clean the small hole in the short vacuum tube which fits into the hole in the top of the engine intake manifold. Do not enlarge this hole. If there is tension on the external spring, when the plant is operating at no load or light load, it may be due to improper adjustment, restricted hole in the small vacuum tube, or a leak in the booster diaphragm or gasket.

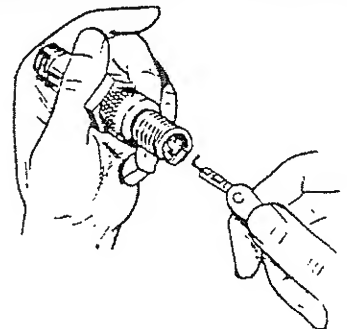
CRANKCASE OIL

Oil capacity is four U.S. quarts. Fill to the *full* mark on oil indicator. Use a good quality detergent oil classified for service MS or MS/DG. Do not use service DS oil at any time. Use the proper SAE number of oil for the expected temperature conditions. Do not mix brands or grades. Extremely dusty or low temperature conditions require oil change at 50-hrs.



CRANKCASE BREATHER

Lift off rubber breather cap. Carefully pry valve from cap. Otherwise press hard with both of your thumbs on top of cap and fingers below to release valve from rubber cap. Wash this fabric flapper type check valve in fuel. Dry and reinstall positioning perforated disc toward engine. Wash valve in fuel, dry and install positioning perforated disc toward engine.



SPARK PLUG GAP
0.025" Gasoline
0.018" Gas

FIG. 4-1

FUEL SEDIMENT

Empty carburetor and fuel filter (strainer) bowls of any accumulated sediment. Clean filter screen thoroughly. Reassemble and check for leaks.

GASOLINE FUEL

Use *regular* grade automobile gasoline. *Do not* use highly leaded *premium* types. Never fill the tank when the engine is running. Leave some tank space for fuel expansion.

MAINTENANCE SCHEDULE

Use this factory recommended maintenance schedule (based on favorable operating conditions) to serve as a guide to get long and efficient plant life. Neglecting routine maintenance can result in failure or permanent damage to the plant. Maintenance is divided into two categories: (1) *operator maintenance* — performed by the operator and (2) *critical maintenance* performed by qualified service personnel (Onan dealer). A Major Service Manual is available (see general information page) if needed.

OPERATOR MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	OPERATIONAL HOURS			
	8	50	100	200
Inspect Plant	x			
Check Fuel	x			
Check Oil Level	x			
Check Air Cleaner		x1		
Clean Governor Linkage		x1		
Check Spark Plug			x	
Change Crankcase Oil			x1	
Clean Crankcase Breather				x
Clean Fuel System				x
Check Battery				x
x1 - Perform more often in extremely dusty conditions.				

For any abnormalities in operation, unusual noises from engine or generator, loss of power, overheating, etc., contact your ONAN dealer.

CRITICAL MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	OPERATIONAL HOURS			
	200	500	1000	5000
Check Breaker Points	x			
Clean Commutator and Collector Rings	x1			
Check Brushes	x2			
Remove Carbon & Lead		x		
Check Valve Clearance		x		
Clean Carburetor		x		
Clean Generator			x	
Remove & Clean Oil Base			x	
Grind Valves			x	
General Overhaul				x
x1 - Perform more often in extremely dusty conditions. x2 - Replace revolving field collector ring brushes when worn to 5/16" or less — Replace all other brushes when worn to 5/8" or less				

x1 - Perform more often in extremely dusty conditions.
x2 - Replace revolving field collector ring brushes when worn to 5/16" or less — Replace all other brushes when worn to 5/8" or less

BOLT TORQUES	FT-LB
Spark Plugs	25-30
Cylinder Head	28-30
Oil Base Mounting	43-48
Spark Plug Gap	Gasoline — 0.025"
	Gas — 0.018"

Tappets (Intake & Exhaust)	0.012" to 0.015"
Ignition Breaker Points Gap	0.020"
Ignition Timing (1500 to 2400 rpm)	19° BTC
Ignition Timing (2500 rpm)	25° BTC

MAJOR SERVICE MANUAL IS AVAILABLE - SEE GENERAL INFORMATION

MAINTENANCE DIAGNOSIS

POSSIBLE CAUSE	REMEDY	POSSIBLE CAUSE	REMEDY
ENGINE WILL NOT CRANK		ENGINE WILL NOT START WHEN CRANKED	
Battery discharged.	Recharge.	Lack of fuel or faulty carburetion.	Refill tank. Check fuel system. Clean, adjust, as necessary.
Loose connections.	Tighten connections.	Clogged fuel screen.	Clean.
Defective starting circuit.	Repair or replace as necessary.	Cylinders flooded.	Crank few times with spark plugs removed.
Defective switch.	Replace.	Poor fuel.	Drain, fill with fresh fuel.
ENGINE CRANKS TOO STIFFLY		Poor compression.	Tighten spark plugs.
Too heavy oil in crankcase.	Drain, refill with lighter oil.	Wrong breaker point gap.	Reset breaker points.

POSSIBLE CAUSE	REMEDY	POSSIBLE CAUSE	REMEDY
EXCESSIVE OIL CONSUMPTION, LIGHT BLUE SMOKY EXHAUST		ENGINE MISFIRES AT LIGHT LOAD	
Oil leaks from oil base or connections. This does not cause smoky exhaust.	Replace gaskets. Tighten screws and connection. Check breather valve.	Spark plug gap too narrow.	Adjust to correct gap.
Oil too light or diluted.	Drain, refill with correct oil.	Intake air leak.	Tighten or replace manifold and carburetor gaskets
Engine misfiring.	Clean, adjust, or replace spark plugs.	Faulty ignition.	Clean, adjust or replace spark plugs.
Faulty ignition.	Clean, adjust, or replace spark plugs.	Low compression.	Tighten cylinder head or spark plugs. Grind valve
Too much oil.	Drain excess oil.	ENGINE MISFIRES AT HEAVY LOAD	
BLACK, SMOKY EXHAUST, EXCESSIVE FUEL CONSUMPTION, FOULING OF SPARK PLUG WITH SOOT, POSSIBLE LACK OF POWER UNDER HEAVY LOAD		Spark plug gap too wide.	Adjust gap.
Fuel mixture too rich.	Adjust carburetor or choke. Install needed carburetor parts.	Faulty ignition.	Clean, adjust or replace spark plugs.
Choke not open.	Inspect linkage and setting.	Clogged carburetor.	Clean jet and adjust carb.
Dirty air cleaner.	Clean.	Clogged fuel screen.	Clean
Excessive crankcase pressure.	Clean breather valve.	ENGINE BACKFIRES	
ENGINE STOPS UNEXPECTEDLY		Lean fuel mixture.	Clean or adjust carburetor.
Fuel tank empty.	Fill with fresh fuel.	Poor fuel.	Refill with good, fresh fuel.
Defective ignition.	Check ignition system.	ENGINE RACES	
SHARP METALLIC THUD, ESPECIALLY WHEN COLD ENGINE FIRST STARTED		Governor not controlling carburetor.	Check governor performance & linkage condition
Low oil supply.	Add oil.	LOW OIL PRESSURE	
Oil badly diluted.	Change oil.	Defective gage.	Replace.
PINGING SOUND WHEN ENGINE IS SUDDENLY OR HEAVILY LOADED		Oil too light or diluted from leaking fuel pump diaphragm.	Drain. Refill with proper oil. Repair or replace fuel pump.
Wrong spark plug.	Install correct spark plug.	Oil too low.	Add oil.
Spark plug burned or carboned.	Install new plug.	Sludge on oil cup screen.	Clean screen & oil sump.
Fuel stale or low octane.	Use good, fresh fuel.	Badly worn oil pump.	Replace.
Lean fuel mixture.	Clean & adjust carburetor.	HIGH OIL PRESSURE	
LIGHT POUNDING KNOCK		Defective gage.	Replace.
Low oil supply.	Add oil.	Oil too heavy grade.	Drain. Refill.
Oil badly diluted.	Change oil.	Clogged oil passages.	Clean all lines & passages
		Oil relief valve stuck.	Clean by-pass. Replace if needed.
		ENGINE OVERHEATING	
		Insufficient cooling air.	Check air entrance and exit
		Improper lubrication.	See Low Oil Pressure.

<u>POSSIBLE CAUSE</u>	<u>REMEDY</u>	<u>POSSIBLE CAUSE</u>	<u>REMEDY</u>
Fuel mixture too lean.	Adjust carburetor.	GENERATOR OVERHEATING (Approximately 160°F higher than ambient)	
Generator overloaded.	Reduce load.	Overloaded.	Reduce load.
VOLTAGE LOW AT FAR END OF LINE BUT NORMAL NEAR POWER PLANT		VOLTAGE DROPS UNDER HEAVY LOAD	
Too small line wire for load and distance.	Install larger or extra wires or reduce load.	Engine lacks power.	See remedies for engine misfires under heavy load.
ELECTRIC MOTOR RUNS TOO SLOWLY AND OVER- HEATS AT FAR END OF LINE BUT OK IF USED NEAR POWER UNIT		Poor compression.	Tighten cylinder head & spark plugs.
Too small line wire for load and distance.	Install larger or extra wires or reduce load.	Faulty carburetion.	Clean the fuel system. Clean, adjust or replace parts necessary.
VOLTAGE UNSTEADY BUT ENGINE NOT MISFIRING		Dirty air cleaner.	Clean.
Speed too low.	Adjust governor to correct speed.	Restricted exhaust line.	Clean or increase the size
Loose connections.	Tighten connections.	Choke partially closed.	See that it opens fully.
Fluctuating load.	Correct any abnormal load condition causing trouble.		

<u>POSSIBLE CAUSE</u>	<u>REMEDY</u>	<u>POSSIBLE CAUSE</u>	<u>REMEDY</u>
Fuel mixture too lean.	Adjust carburetor	GENERATOR OVERHEATING (Approximately 160°F higher than ambient)	
Generator overloaded	Reduce load.	Overloaded.	Reduce load.
VOLTAGE LOW AT FAR END OF LINE BUT NORMAL NEAR POWER PLANT		VOLTAGE DROPS UNDER HEAVY LOAD	
Too small line wire for load and distance.	Install larger or extra wires or reduce load.	Engine lacks power.	See remedies for engine misfires under heavy load
ELECTRIC MOTOR RUNS TOO SLOWLY AND OVER- HEATS AT FAR END OF LINE BUT OK IF USED NEAR POWER UNIT		Poor compression.	Tighten cylinder head & spark plugs.
Too small line wire for load and distance.	Install larger or extra wires or reduce load.	Faulty carburetion.	Clean the fuel system Clean, adjust or replace parts necessary.
VOLTAGE UNSTEADY BUT ENGINE NOT MISFIRING		Dirty air cleaner.	Clean.
Speed too low	Adjust governor to correct speed.	Restricted exhaust line.	Clean or increase the size
Loose connections.	Tighten connections.	Choke partially closed.	See that it opens fully
Fluctuating load.	Correct any abnormal load condition causing trouble.		

INSTRUCTIONS FOR ORDERING REPAIR PARTS

For parts or service, contact the dealer from whom you purchased this equipment or refer to your Nearest Authorized Parts & Service Center.

To avoid errors or delay in filling your parts order, please furnish all information requested.

Always refer to the nameplate on your plant:

1. Always give the MODEL & SPEC. NO. and SERIAL NO.

For handy reference, insert YOUR plant nameplate information in the spaces above.

2. Do not order by reference number or group number, always use part number and description.
3. Give the part number, description and quantity needed of each item. If an older part cannot be identified, return the part prepaid to your dealer or nearest AUTHORIZED SERVICE STATION. Print your name and address plainly on the package. Write a letter to the same address stating the reason for returning the part.
4. State definite shipping instructions. Any claim for loss or damage to your unit in transit should be filed promptly against the transportation company making the delivery. Shipments are complete unless the packing list indicates items are back ordered.

Prices are purposely omitted from this Parts Catalog due to the confusion resulting from fluctuating costs, import duties, sales taxes, exchange rates, etc.

For current parts prices consult your Onan Dealer, Distributor, or Parts and Service Center.

"En esta lista de partes los precios se omiten de proposito, ya que bastante confusion resulto de fluctuaciones de los precios, derechos aduanales, impuestos de venta, cambios extranjeros etc.

Consiga los precios vigentes de su distribuidor de productos "ONAN".

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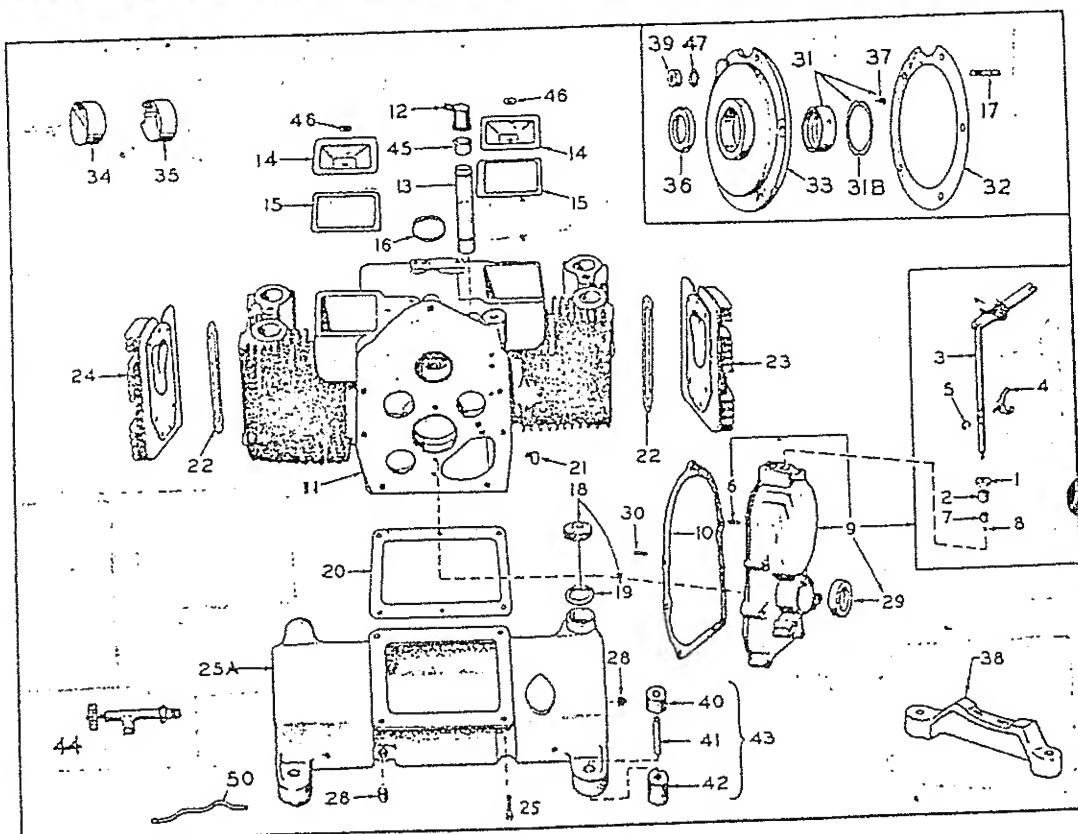


Fig A - CYLINDER, BLOCK, OIL BASE & GEAR COVER GROUP.

KEY	PART NO.	QTY	DESCRIPTION
1	509P8	1	Seal, Oil - Governor Shaft
2	510P13	1	Bearing, Governor Shaft Upper
3	150-710	1	Shaft and Arm Assembly, Governor
4	150A620	1	Yoke, Governor Shaft
5	518-129	1	Ring, Yoke Retainer "E"
6	516-130	1	Pin, Roll-Governor Cup Stop - Located in Gear Cover $5/16"$ x $7/8"$
7	510A8	1	Bearing, Governor Shaft Lower
8	510P14	1	Ball, Bearing, - Governor Shaft
9	103-207	1	Cover Assembly, Gear - Includes Cover and Items 1 to 8 plus 29 (Replaces 1030156).
10	103B11	1	GasJet, Gear Cover
11	110A915	1	Block Assembly, Cylinder - Includes Bearing Plate and Studs, Bearings, Dowel Pins, Valve Guides and Valve Seat Inserts, Welch Plug.
12	123B205	1	Cap, Breather Tube Rubber
13	123A129	1	Tube, Breather - Replaces 123A591 and 123A620.

KEY	PART NO.	QTY	DESCRIPTION
14	11CA666	2	Cover, Valve Compartment
15	11CA667	2	Gasket, Valve Cover
16	517-48	1	Plug, Camshaft Expansion
17	52CA114	5	Stud, Rear Bearing Plate 5/16" x 1-5/16"
18	1C3A489	1	Indicator and Cap, Oil Fill
19	123A191	1	Gasket, Oil Fill Cap
20	1C2B150	1	Gasket, Oil Base Mounting
21	502A20	1	Elbow, Street, - Oil Line
22	11CA892	2	Gasket, Cylinder Head
23	11CD391	1	Head, Right Hand / 2 Cylinder
24	11CD391	1	Head, - Left Hand / 1 Cylinder
25	102A495	4	Screw, Cap - Oil Base to Block
25A	102A428	1	Base, Oil (Replaces 102A350)
28	505-110	3	Plug, Pipe - 3/8" - Oil Drain
29	509A40	1	Seal, Oil - Gear Cover (Single and Double Lip - Interchangeable).
30	516A11	2	Pin, Gear Cover Dowel - 5/16" x 1-1/8"
31	101K323	2	Bearing, Crankshaft - Front or Rear Specify: Standard, .002" .010" .020" or .030" Undersize.
31B	104A371	2	Washer, Thrust - Crankshaft Bearing - Included with Bearing.
32	101K115	1	Gasket Kit, Bearing Plate
33	101C316	1	Plate, Bearing, - Excludes Bearing.
34	101A367	1	Bearing, Camshaft Front
35	101A367	1	Bearing, Camshaft Rear
36	509A41	1	Seal Oil - Bearing Plate (Single and Double Lip - Interchangeable).
37	516A72	4	Pin, Main Bearing Stop - Included with Bearing.
38	232C1257	1	Support, Generator
39	110A445	5	Nut, Bearing Plate Stud
40	402A131	4	Cushion, Plant Mounting - Upper
41	402A137	4	Bushing, Spacer
42	402A38	4	Cushion, Plant Mounting - Lower
43	402A145	4	Cushion, Assembly, Plant Mounting Includes Cushions, Spacer Bushing and Hardware.
44	251/GMP/XA 352	1	Cock, Oil Drain (Replaces X121, XA159, XA244)
45	123A104	1	Valve, Breather Tube
46	526-63	2	Washer, Copper - Valve Compartment cover
47	851-5	5	Washer, Lock - 5/16" x Special Width - Rear Bearing Plate.
50	120A386	1	Tube, Crankcase Oil (Pressed in Block)

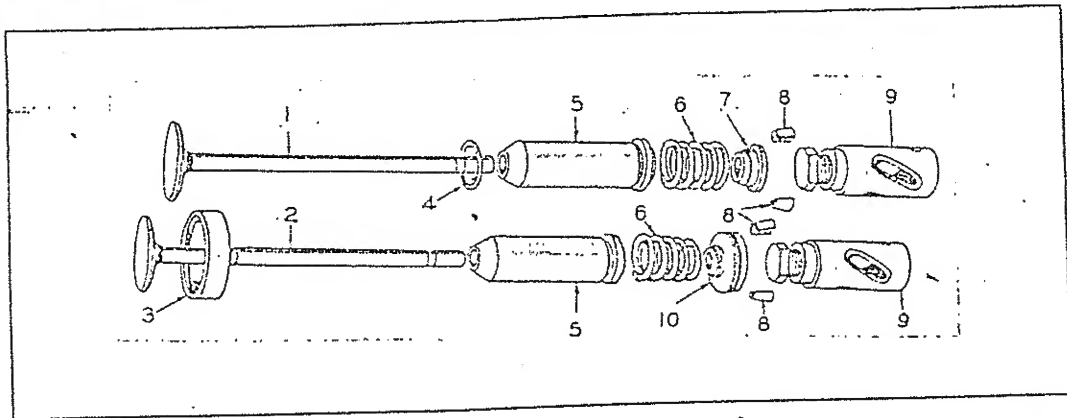


Fig B - VALVE GROUP

KEY	PART NO.	QTY	DESCRIPTION
1	110B881	2	Valve, Intake - Steel
2	110B880	2	Valve, Exhaust - Stellite
3	110A872	2	Insert, Exhaust Valve Seat - Stellite Specify: Standard .002" .005" or .010" .025" Oversize.
5	110A902	4	Guide, Valve
6	110A539	4	Spring, Valve.
7	110A895	2	Washer, Valve Spring Retainer - Intake only
8	110A639	8	Lock, Rotocap or Spring Retainer Washer.
9	115A6	4	Tappet, Valve - Specify: Standard or .005" Oversize.
10	110A904	2	Rotocap, Exhaust Valve.

★★SCREWS ASSOCIATED WITH FIG. A.

KEY	PART NO.	QTY	DESCRIPTION
			Screw, Hex Head Cap - Hardened.
	110A872	8	Cylinder Head - 5/16" -18 x 1-1/4"
	114A22	10	Cylinder Head - 5/16" -18 x 1-3/4"
	114A22	4	Gear Cover - 5/16" -18 x 1-3/4"
	800-54	1	Gear Cover - 5/16" -18 x 2-1/4"
	800-54	2	Intake Manifold - 3/8" -16 x 2"
	526A122	18	Washer, Flat-Cylinder Head Screws.

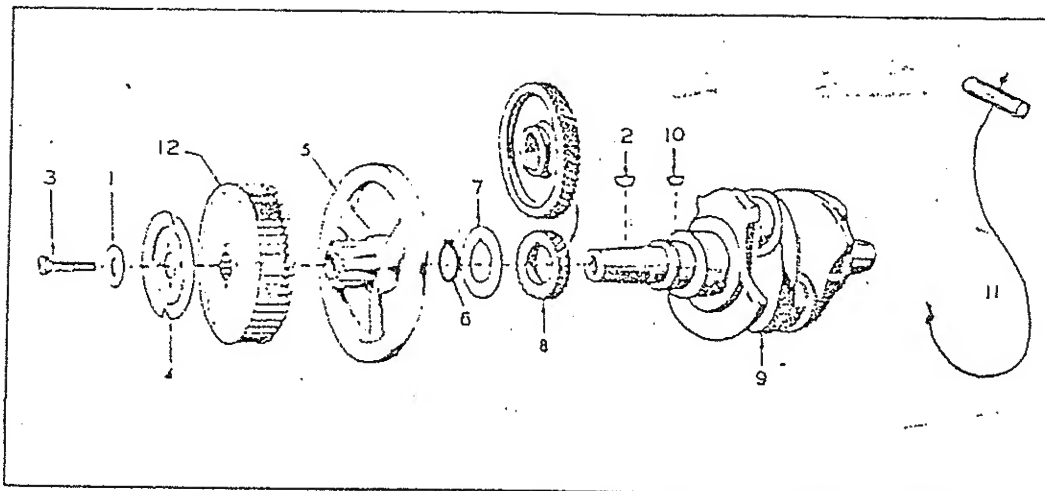


Fig C - CRANKSHAFT & FLYWHEEL GROUP

KEY	PART NO.	QTY	DESCRIPTION
1	52CA17	1	Washer, Wheel Mounting
2	515-2	1	Key, Wheel Mounting
3	104A170	1	Screw, Wheel Mounting
4	192B272	1	Sheave, Rope
5	104D499	1	Flywheel. (Replaces 104D265)
6	513-14	1	Lock, Crankshaft Gear Washer
7	104A43	1	Washer, Crankshaft Gear Retainer
8	105-192	1	Gear Set, Timing - Includes Crankshaft & Camshaft Gears, Flyball Spacer & Plate (listed also Fig.D)
9	104D256	1	Crankshaft
10	515-1	1	Key, Crankshaft Gear Mounting
11	192A83	1	Rope, Manual Starting
12	134B565	1	Wheel, Blower

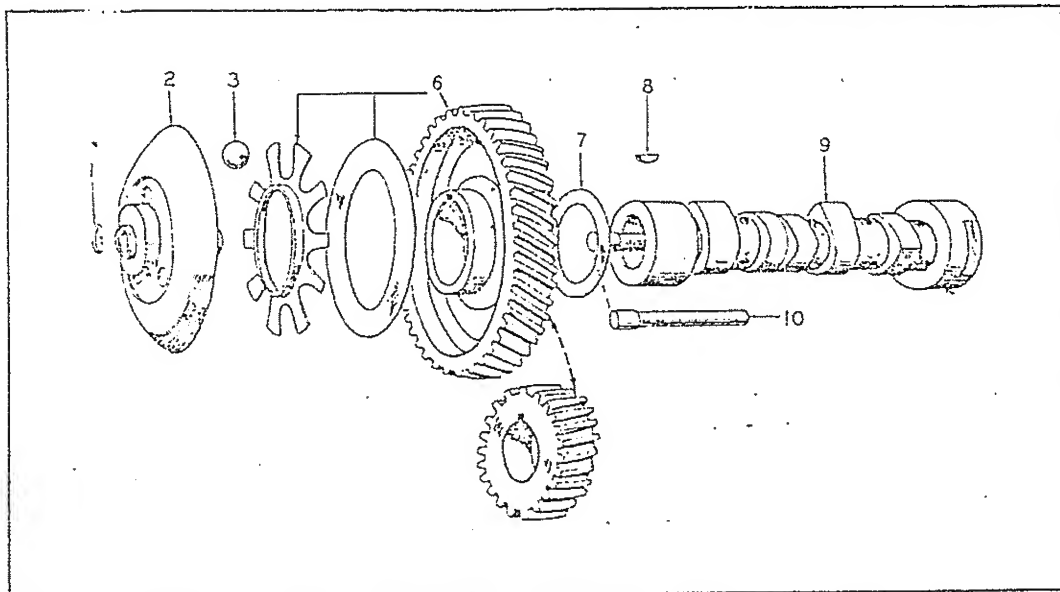


Fig D - CAMSHAFT GROUP

KEY	PART NO.	QTY	DESCRIPTION
1	150A78.	1	Ring, Camshaft Centre Pin Snap
2	150A612	1	Cup, Governor,
3	510P15	10	Ball, Governor Fly
6	105-192	1	Gear Set, Timing - Includes Camshaft & Crankshaft Gears, Flyball Spacer & Plate (Listed also Fig. C)
7	105A4	1	Washer, Camshaft Gear Thrust
8	515-1	1	Key, Camshaft Gear Mounting
9	105-140	1	Camshaft - Includes Centre Pin
10	150A78	1	Pin, Camshaft Centre

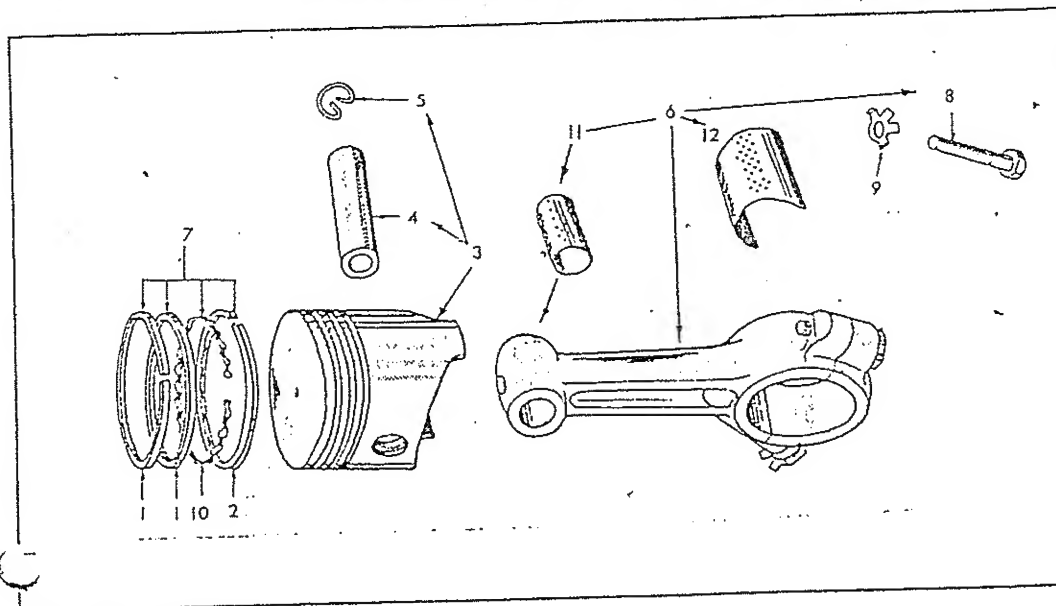


Fig E-CONNECTING ROD & PISTON GROUP

KEY	PART NO.	QTY	DESCRIPTION
1	-	4	Ring, Compression - Order Ring Set 113A88
2	-	2	Ring, Oil Control - Order Ring Set 113A88
3	112A71	2	Piston and Pin - Includes Retaining Rings Specify: Standard, .010" .020" .030" or .040" Oversize.
4	112A69	2	Pin, Piston - Specify: Standard or .002" C/S
5	112A5	4	Ring - Piston Pin Retaining
6	114B125	2	Rod, Connecting
7	113A88	2	Ring Set, Piston - Specify: Standard .010" .020" .030" or .040" Oversize
8	805-10	4	Screw-Connecting Rod Cap
9	114A59	4	Washer-Connecting Rod Cap Screw Lock
10	113A85	2	Expander, Oil Ring
11	114A36	2	Bushing, Piston Pin
12	114-55	4	Bearing, Con-Rod Specify: Standard .002" .010" .020" .030" (Two Types in service plain and with oil hole).

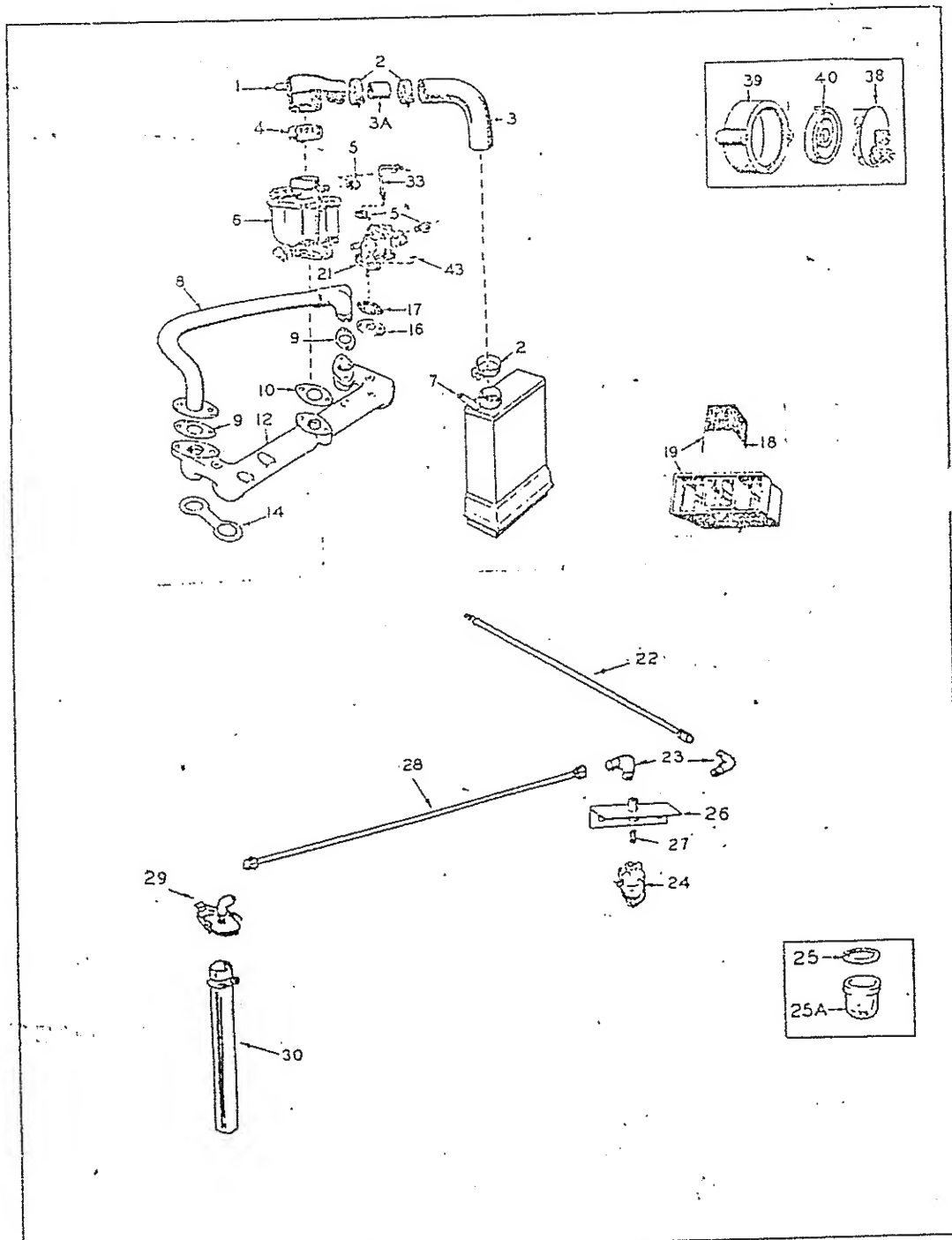


Fig F FUEL SYSTEM GROUP

KEY	PART NO.	QTY	DESCRIPTION
1	145B80	1	Inlet, Carburettor Air
2	503-280	3	Clamp, Air Cleaner Hose.
3	503A286	1	Hose, Air Cleaner
3A	140A211	1	Sleeve, Air Cleaner Hose.
4	503-107	1	Clamp, Air Inlet to Carburettor
5	502-2	3	Elbow, Fuel Pump In & Outlet
6	142A364	1	Carburettor Assembly, Petrol.
7	140C399	1	Cleaner, Air.
8	154C372	1	Manifold, Exhaust
9	154A360	2	Gasket, Exhaust Manifold
10	141A78	1	Gasket, Carburettor Mounting
12	154A383	1	Manifold, Intake
14	154A13	2	Gasket, Intake Manifold
16	140A45	1	Spacer, Fuel Pump
17	140A3	2	Gasket, Fuel Pump & Spacer Mounting
18	140A63	1	Screen, Air Cleaner
19	140K403	1	Cup- Assy, Air Cleaner - Includes Screen
21	149D693	1	Pump, Fuel (Replaces 149C602).
22	250/GMP/XL47	1	Pipe, Petrol - 1 1/2 inches (Replaces XL40).
23	250/GMP/XL45	2	Elbow - Brass (Replaces XL41)
24	149B79	1	Filter, Fuel.
25	149-149	1	Gasket, Filter Bowl
25A	149-150	1	Bowl, Fuel Filter
26	149A616	1	Bracket, Fuel Filter
27	502-46	1	Nipple - Brass
28	250/GMP/XL31	1	Pipe, Petrol. - 5ft (Replaces XL25).
29	250/GMP/XL30	1	Cap, Special Jerrican Assy. (Replaces XL24)
30	250/GMP/XL24A	1	Tube, Petrol Jerrican
-	250/GMP/XL44	1	Strainer, Jerrican Tube.
33	149A611	1	Line Fuel - Fuel Pump to Carb,
38	153A113	1	Cover, Electric Choke
39	153A58	1	Bracket, Electric Choke
40	153A17	1	Element, Choke Bi-Metal
43	526-63	2	Washer, Flat Copper - Fuel Pump Mtg.
-	336A1050	1	Load, Electric Choke to Control

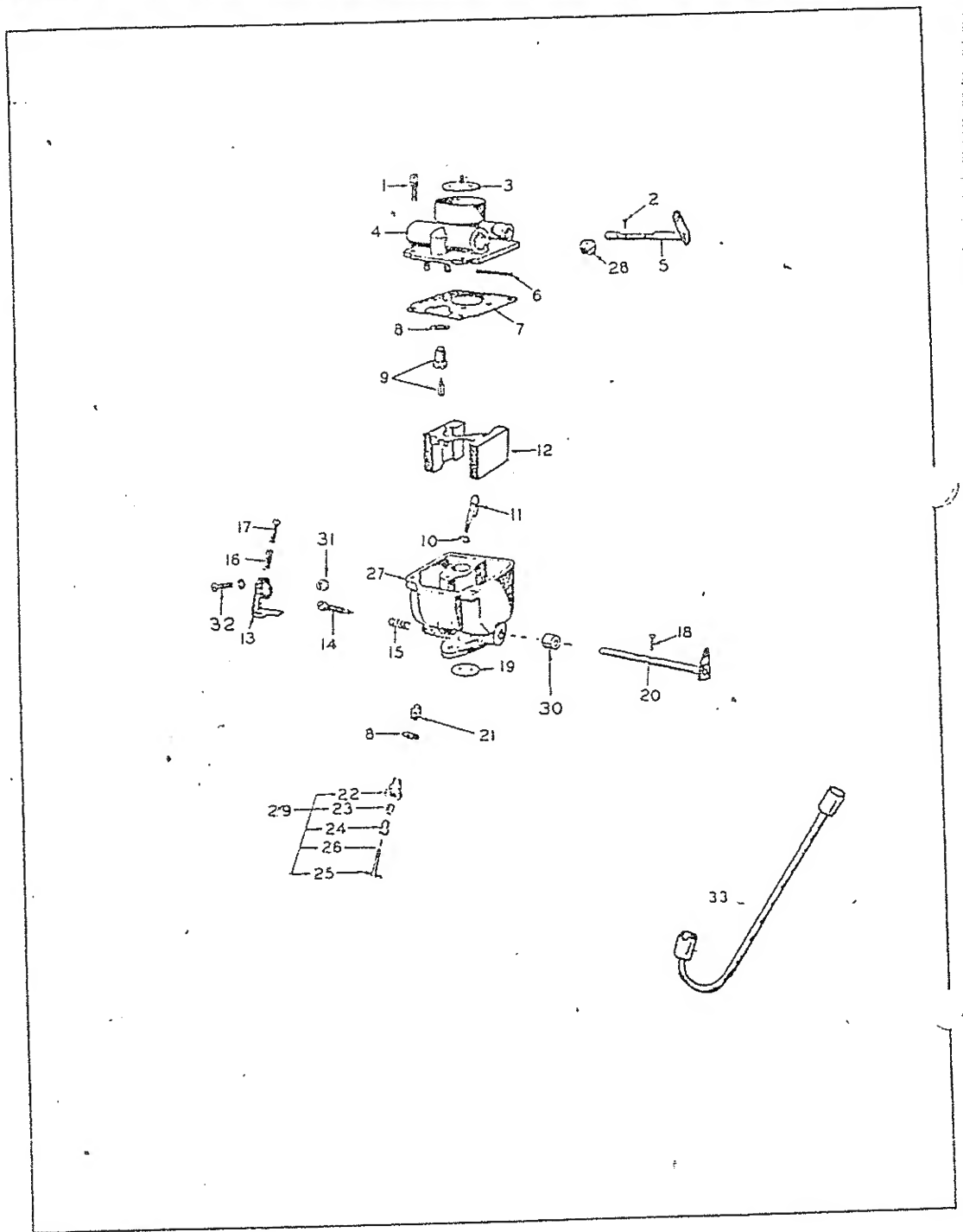


Fig G - CARBURETTOR PARTS GROUP

KEY	PART NO.	QTY	DESCRIPTION
-	142A364	1	Carburettor
1			Screw, Bowl Cover.
	815-103	1	10-24 x 1/2"
	815-103	2	10-24 x 5/8"
2	815-91	2	*Screw, Choke Fly - 4-40 x 3/16"
3	142-37	1	Fly, Choke
4	142-205	1	Sleeve Assembly, Choke (Cover)
5	142-183	1	Shaft Assembly, Choke
6	142-39	1	*Shaft, Float
7	142-31	1	Gasket, Body to Bowl
8	142A17	2	Gasket, (1) Float Valve Seat, (1) Main Adjusting Needle Retainer.
9	142-49	1	*Valve & Seat Assembly, Float - Includes Gasket.
10	142-32	1	Gasket, Nozzle.
11	142-285	1	Nozzle Assembly
12	142-361	1	Float & Lever Assembly (Replaces 142-38)
13	145A3	1	Lever, Idle Stop
14	142-40	1	Needle, Idle Adjusting
15	142-282	1	Spring, Idle Needle Adjusting
16	142A35	1	Spring, Throttle Stop Adj. Screw
17	812-63	1	Screw, Throttle Stop Adj. 6-32 x 1/2"
18	812-72	2	*Screw, Throttle Fly 4-40 x 1/4"
19	142-369.	1	Fly, Throttle
20	142-368	1	*Shaft Assembly, Throttle
21	142-370	1	Nut & Jet, Nozzle
22	142-46	1	Retainer, Main Adjusting Needle.
23	142-206	1	Packing, Main Adjusting Needle.
24	142-45	1	Retainer, Main Adj. Needle Packing.
25	516A27	1	Pin, Main Adjusting Needle.
26	142A41	1	*Needle, Main Adjusting
27		1	Body Assembly - Not Sold Separately
28	505-53	1	Plug, Gas Inlet
29	142-42	1	Needle Assembly - Includes Packing Nut and Retainer.
30	142-343	2	Bushing, Throttle Shaft
31	870-53	1	Nut, Throttle Stop
32	813-102	1	Screw, Throttle Stop Clamp
33	420C169	1	Wrench, Carb. Adjusting.
-	142-33	1	*Gasket Kit, Carburettor
-	142K371	1	Repair Kit, Carburettor - Includes Parts Marked *

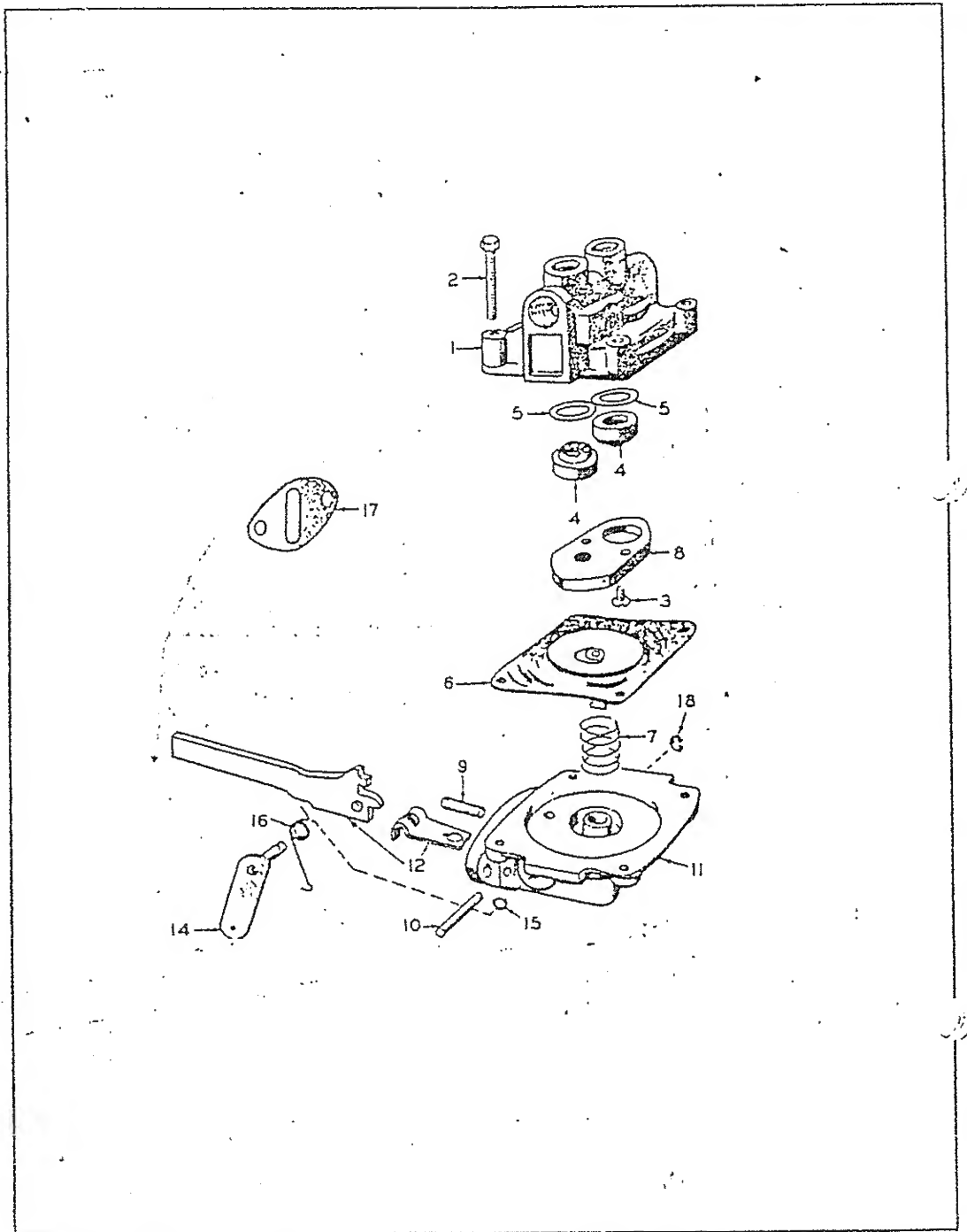


Fig. H. FUEL PUMP PARTS. GROUP. . .

KEY	PART NO.	QTY	DESCRIPTION
-	149D695	1	Pump, Fuel (Replaces 149C602)
1	-	1	Body, Upper - Not Sold Separately
2	215-148	4	Screw, Hex Head 3-32 x 7/8" Pump Assy
3	215-147	2	Screw, Phillips Flat Head 6-32 x 5/8"
			Valve Retainer.
4	149F96	*2	Valve and Cage
5	149A95	*2	Gasket, Valve
6	149A982	*1	Diaphragm Assembly
7	149A672	*1	Spring, Diaphragm (Replaces 149A95)
8	149A539	1	Retainer, Valve Cage.
9	149A575	*1	Spring, Rocker Arm (Replaces 149A94)
10	516A113	1	Pin, Rocker Arm
11	-	1	Body, Lower - Not Sold Separately
12	149-710	1	Arm & Link Set, Rocker, Sold Only as a set.
14	149A551	1	Lever, Hand Primer
15	509-65	2	Seal, "O" Ring.
16	149A404	1	Spring, Fuel Pump Priming Lever
17	149A3	*1	Gasket, Fuel Pump Mounting
18	518-129	1	Ring, "E" Retainer - Priming Lever Shaft.
19	149A853	*1	Gasket, Diaphragm
-	149K526	1	Repair Kit, Fuel Pump - Contains parts marked *

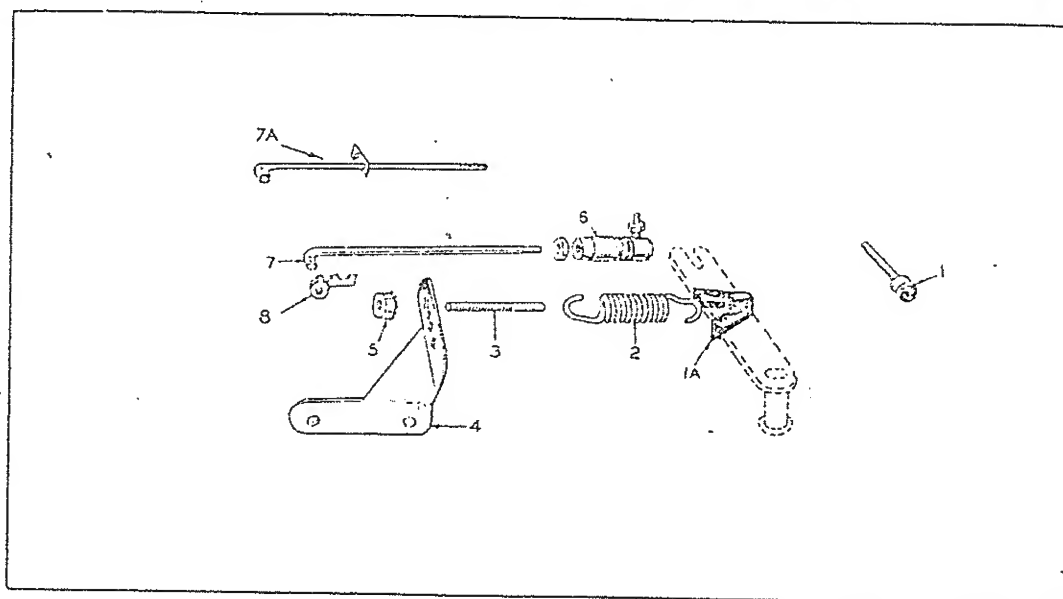


Fig J - GOVERNOR GROUP

KEY	PART NO.	QTY	DESCRIPTION
1	150A136	1	Screw, Governor Sensitivity Adjusting (Spec. 3490G)
1A	150A678	1	Clip, Governor Sensitivity Adjusting (Spec. 2974G)
2	150A96	1	Spring, Governor
3	150A96	1	Stud, Governor Speed Adjusting
4	150A40	1	Bracket, Governor Spring
5	870-131	1	Nut, Keps - Governor Speed Adjusting
6	150A639	1	Joint, Governor Link Ball
7	150A629	1	Rod, Gov. Arm to Carb. (Spec. 2974G)
7A	150A953	1	Rod, Gov. Arm to Carb. (Spec. 3940G)
8	518-6	1	Clip, Rod End

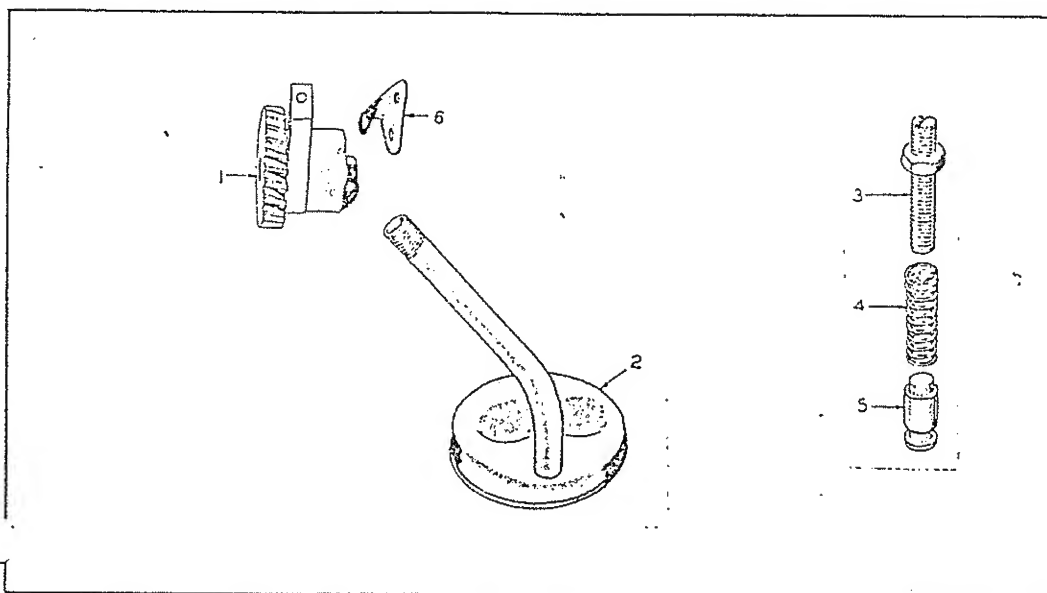


Fig X — OIL PUMP GROUP

KEY	PART NO.	QTY	DESCRIPTION
1	120A491	1	Pump, Oil - Complete - Internal Parts Not sold separately. (Replaces 120A394)
2	120B400	1	Cup, Oil Pump Intake - Includes Pipe, Cup and Screen.
3	120A187	1	Stud Assembly, By-Pass Adjusting Includes Stud and Nut.
4	120A141	1	Spring, By-Pass Valve.
5	120A398	1	Valve, By-Pass.
6	120K161	1	Gasket Kit, Oil Pump
-	526-66	1	Washer, Copper - Oil Pressure Relief Valve, Adjusting Screw.

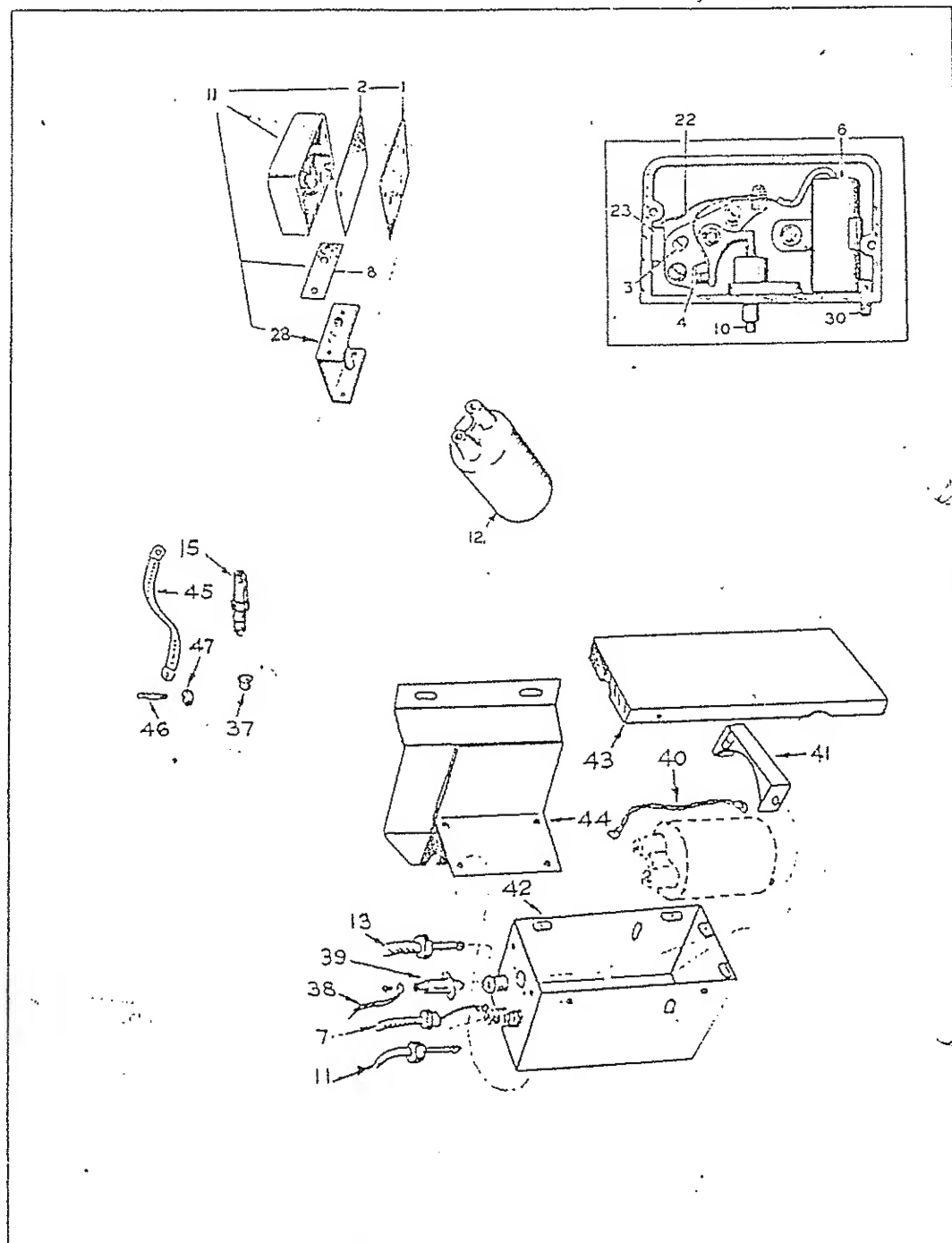


Fig. 1. — IGNITION GROUP.

KEY	PART NO.	QTY	DESCRIPTION
1	160A152	1	Cover, Breaker Box
2	160A440	1	Gasket, Breaker Box Cover
3	160A75	1	Pivot, Breaker Arm
4	160A2	1	Point Set, Breaker
6	312A69	1	Condenser, Breaker Box - 0.5 Mfd
7	336A1310	1	Lead, Coil to Breaker Box
8	160A43	1	Gasket, Breaker Box Mounting
10	160A462	1	Plunger, Breaker - Includes Plunger, Diaphragm and Guide.
11	160A671	1	Box Assembly, Ignition Breaker - Complete
12	160C792	1	Coil, Ignition.
13	167A1347	1	Cable, Spark Plug - Screened - Left Hand 28 $\frac{1}{2}$ " long.
14	167A1400	1	Cable Spark Plug - Screened - Right Hand 22 $\frac{1}{2}$ " long.
15	167-20	2	Plug, Spark - Screened
28	160A246	1	Spacer, Breaker Box
30	160A261	1	Wick, Breaker Box Oil Drain
-	815-111	1	Screw, Fill Head - 1/4"-20 x 5/8" Breaker Box Mounting.
-	815-112	1	Screw, Fill Head - 1/4"-20 x 3/4" Breaker Box Mounting
-	812-153	1	Screw, Round Head, - 1/4"-20 x 1" Ignition Coil.
36	167A61	1	Hipple, Shield - Breaker Box
37	517P61	1	Plug, Breaker Box
38	336A1070	1	Lead, Coil Suppression.
39	312P83	1	Condenser - Ignition Coil Suppression
40	334-28	1	Lead, Coil to Condenser.
41	301A1873	1	Clamp, Ignition Coil.
42	301-1975	1	Box, Ignition Coil.
43	301B1994	1	Cover, Ignition Coil Box
44	160A878	1	Bracket Ignition Coil Box
45	337A59	1	Strap, Ground Manifold to Air, Housing.
46	520-603	1	Stud, Ground Cable, (Spec.2974G)
46A	520A580	1	Stud, Ground Cable, (Spec.3490G)
47	864-3	1	Nut, Ground Stud.
	455/GMP/100	-	Wrench, Breaker Box Timing

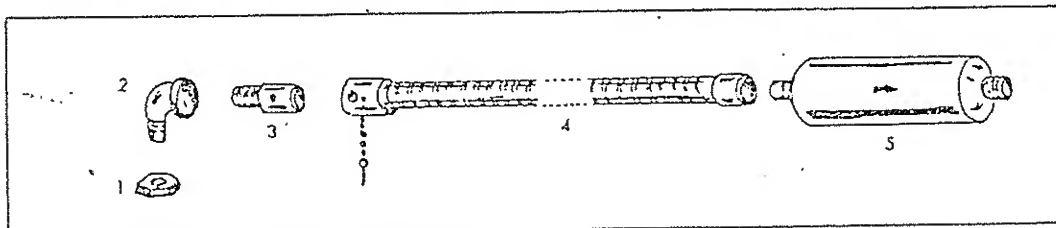


Fig M - EXHAUST GROUP

KEY	PART NO.	QTY	DESCRIPTION
1	251/GMF/300	1	Locknut
2	251/GMF/A355/11	1	Elbow
3	204/GMF/XA160/1	1	Coupling, Quick Release - Male, (Replaces K122).
4	203/GMF/XA160/4	1	Pipe, Flexible, Complete with Q.R. Female (Replaces K130).
5	205/GMF/115	1	Silencer, (Superceeds 155B518).

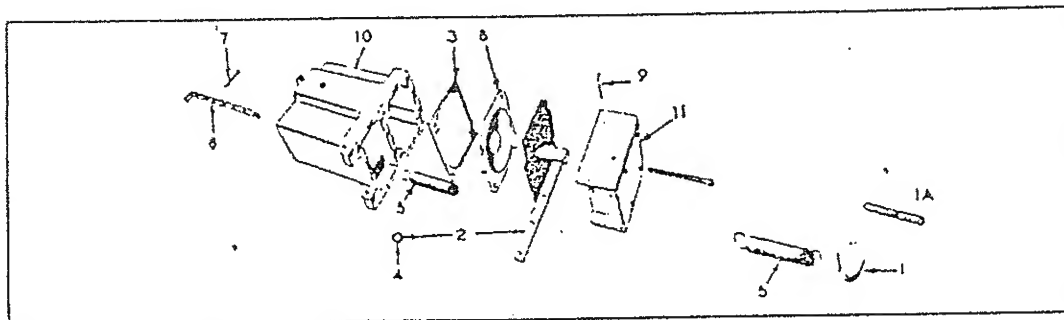


Fig N - VACUUM SPEED BOOSTER GROUP

-	150K433	1	Kit, Vacuum Booster Replacement - Includes External Spring & Mtg. Gasket.
1	150A433	1	Clip, Spring to Gov. Link (Spec.29740).
1A	150A96	1	Stud Spring to Gov. Link (Spec.34903).
2	150K434	1	Kit, Diaphragm Replacement - Includes Gaskets.
3	150A668	1	Gasket, Diaphragm Plate (Replaces 150A374)
4	150A425	1	Gasket, Booster to Manifold - Neoprene
5	150A366	2	Spring, Internal or External - 1 each
6	150A376	1	Bracket, Internal Spring Adjusting
7	516-39	1	Pin, Collar 3/32 x 5/8" Adj. Bracket
8	150A666	1	Plate, Diaphragm (Replaces 150A375)
9	516A35	1	Pin, Roll 3/32 x 3/4" - Diaphragm Lever Pivot.
10	-	1	Housing, Not sold separately.
11	-	1	Cover, - Not sold separately.

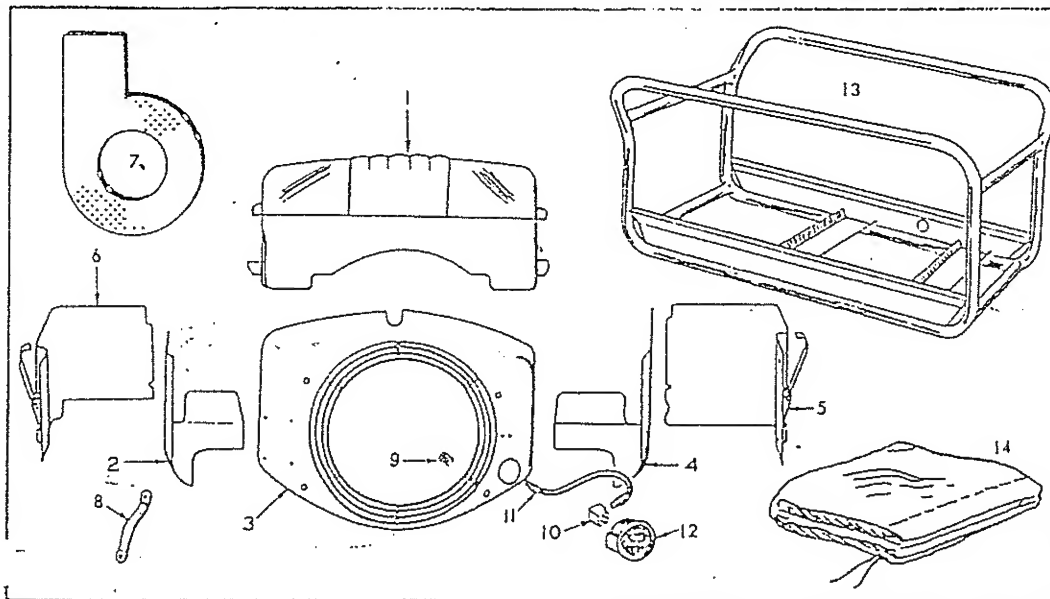


Fig O-AIR HOUSING, FRAME & COVER GROUP

KEY	PART NO.	QTY	DESCRIPTION
1	40501013	1	Hood, Engine
2	134D589	1	Housing, Cyl. Air -L.H.
3	134D594	1	Housing, Blower
4	134D588	1	Housing, Cyl. Air -, R.H.
5	134C1596	1	Cover, Cyl. -R.H. (Replaces 1340662)
6	134D663	1	Cover, Cyl. - L.H.
7	134D564	1	Scroll, Air
8	352/GMF/XA267	1	Strap, Earth Plant to Frame.
9	879-110	4	Nut, Speed Grip (Used prior ser. no. 745272).
10	502-5	1	Elbow, Inverted Female - Oil Gauge.
11	501A4	1	Line, Flexible Oil.
12	193P5	1	Gauge, Oil Pressure
13	200/GMF/XA336	1	Frame (Superceeds KC102; K125).
14	207/GMF/XA201	1	Cover, Canvas Waterproof (Replaces K143).

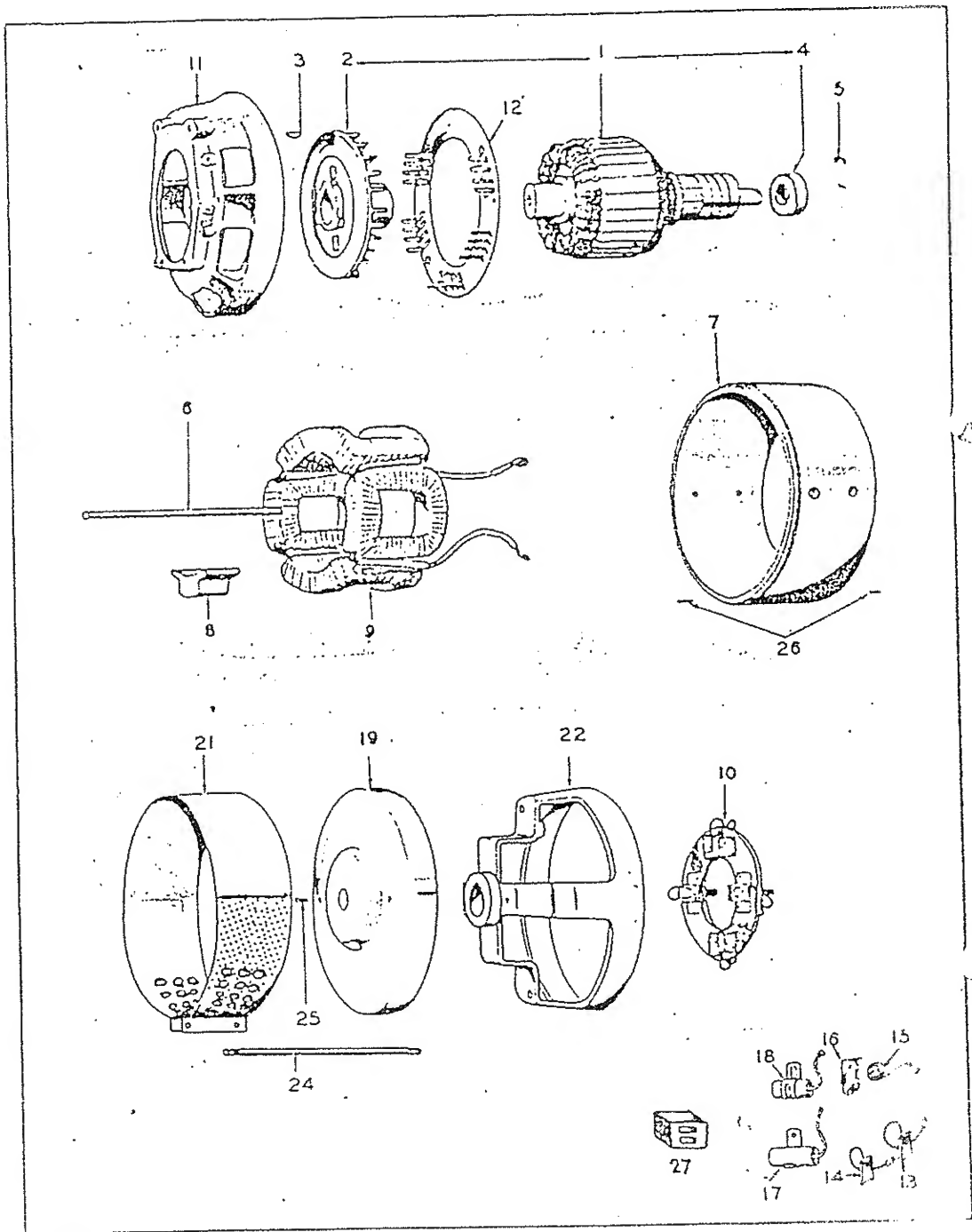


Fig P — GENERATOR GROUP

REF	PART NO.	QTY	DESCRIPTION
1	201-1185	1	Armature Assy - Includes Bearing & Blower
2	205C53	1	Blower, Generator
3	515-6	1	Key, Blower to Crankshaft
4	510A47	1	Bearing Ball - Armature.
5	232A596	1	Clip, Bearing Stop
6	520A525	1	Stud, Armature Through
7	210D244	1	Frame Only, Generator - Machined & Drilled - Less Coils & Pole Shoes.
8	221A91	4	Shoe, Pole - Field
9	222A1435	1	Coil Assy, Field - Set of 4 Coils .
10	212C234	1	Rig Assembly, Brush
11	251B1C05	1	Adapter, Generator to Engine.
12	252B1256	1	Scroll, Air Baffle
13	214A61	4	Brush, Commutator
14	214A56	4	Brush, Collector Ring
15/16	212B1105	4	Spring, Commutator Brush
	212A1123	4	Spring, Collector Ring Brush
17	312A27	1	Condenser - 0.5 Mfd, DC
18	312A58	3	Condenser - 0.1 Mfd, AC
19	211C99	1	Cover, End Bell
21	254B206	1	Dand, End Bell
22	211D149	1	Bell, End
24	520A502.	2	Stud, Generator Through
25	815-48	2	Screw, Round Head Self Tap 10-32 x 3/8" End Cover Mtg.
26	516-103	2	Pin, Roll - Frame - 1/8" x 1/2"
27	212B1135	2	Brush Holder

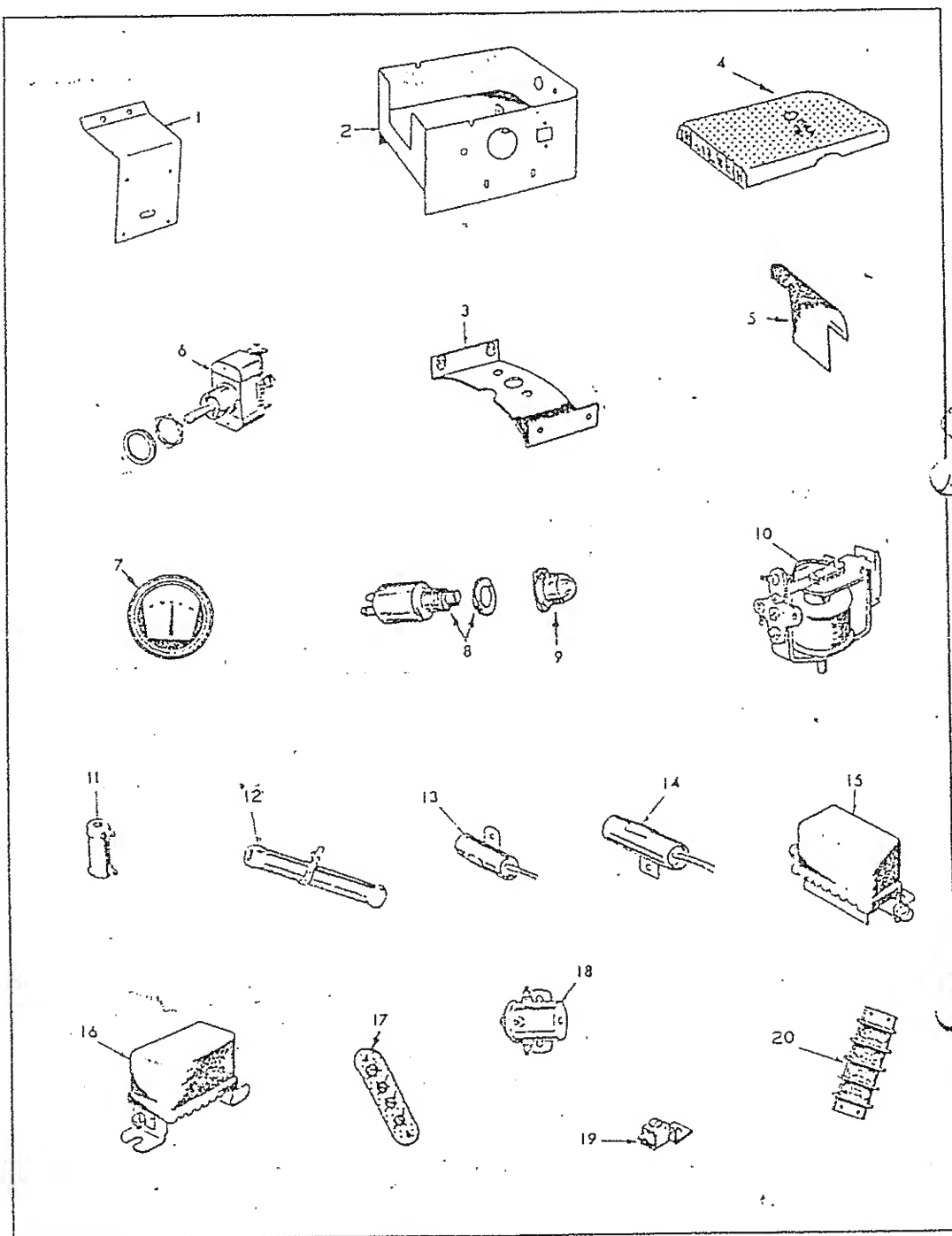


Fig Q—CONTROL GROUP

KEY	PART NO.	QTY	DESCRIPTION
1	30101366	1	Bracket, Instrument Panel Mounting
2	30101482	1	Box, Control - Includes Panel and Resistor Mount.
3	30151118	1	Bracket, Control Box Mounting
4	150/GHE/K154	1	Cover, Control Box
5	301B1271	1	Plate, Control Box End
6	302F154	1	Switch, Start-Stop
7	302A58	1	Gauge, Charge.
8	308-123	1	Switch, (Manual/Electric Start)
9	308-124	1	Cap, Rubber-Switch Cover
10	307B253	1	Relay, Stop
11	304-251	1	Resistor Fixed (30 ohm - 5 watt)
-	304-344	1	" " (1 ohm - 25 watt) 7" x 2"
-	304-60	1	" " (1.72 ohm - 25 watt) (9/16" x 2" Ignition)
12	304A175	1	Resistor, Adjustable (1 ohm) 7" x 4"
13	312A53	3	Condenser - 0.1 Mfd - Load Terminal Suppression.
14	312A57	1	Condenser - 1 Mfd-Start Solenoid Suppression.
15	305A1	1	Regulator, Voltage - Charge Circuit
16	307B180	1	Relay, Reverse Current
17	332A222	1	Block, Terminal - Remote Control
18	307B40	1	Solenoid, Start
19	332-142	1	Terminal, Solderless
-	332A435	1	Strip, Marker
20	332A454	1	Block, Terminal
-	332A198	1	Bracket, Mounting - Remote Control Terminal Block.
-	332A439	1	Jumper, Terminal - Load Terminal Block

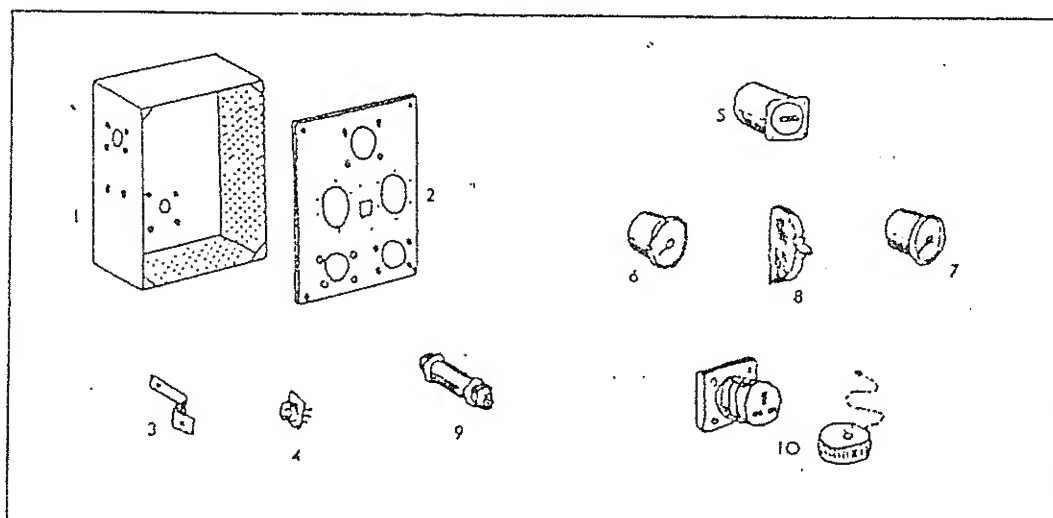


Fig 2 INSTRUMENT PANEL GROUP

KEY	PART NO.	QTY	DESCRIPTION
1	150/GMP/XA231	1	Box Instrument Panel (Replaces XC102; XA237)
2	150/GMP/XA230	1	Front Instrument Panel (Replaces XC102; XA236)
3	150/GMP/XA393	1	Support, Instrument Panel
4	158/GMP/126	1	Socket, Remote Control (Replaces X142)
5	153/GMP/XA249	1	Meter, Running Time (Replaces X114; XA167)
6	153/GMP/XA349/2	1	Voltmeter (Replaces 153/GMP/XA238/2) Note:- Part No. X116; XA164/2 used Mark I type I only, (spec.2974G)
7	153/GMP/XA349/1	1	Ammeter (Replaces 153/GMP/XA238/1) Note:- Part No. X115; XA164/1 used Mark I type I only, (Spec.2974G)
8	157/GMP/XA245	1	Circuit Breaker (Replaces X117; XA163)
9	159/GMP/XA157	1	Nipple, Instrument Panel (Replaces X118)
10	-	2	Socket - Embodiment Loan

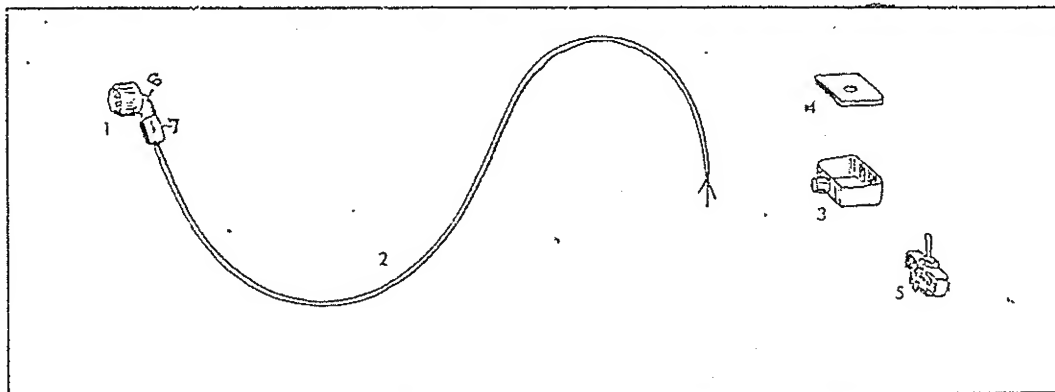


Fig 5 - REMOTE CONTROL GROUP

KEY	PART NO.	QTY	DESCRIPTION
1	158/GMP/125	1	Plug, Remote Lead (Replaces X142)
2	23/.0076" VIR	1	Lead, Remote - 48ft (Replaces X129)
3	150/GMP/XA166	1	Box, Remote Switch (Replaces X128)
4	150/GMP/XA166A	1	Lid, Remote Switch Box (Replaces X128A)
5	151/GMP/XA346	1	Switch, Remote Control (Replaces X127 and 151/GMP/XA165).
6	158/GMP/128	1	Elbow 90° (2CZ108802)
7	158/GMP/129	1	Nut (271253)

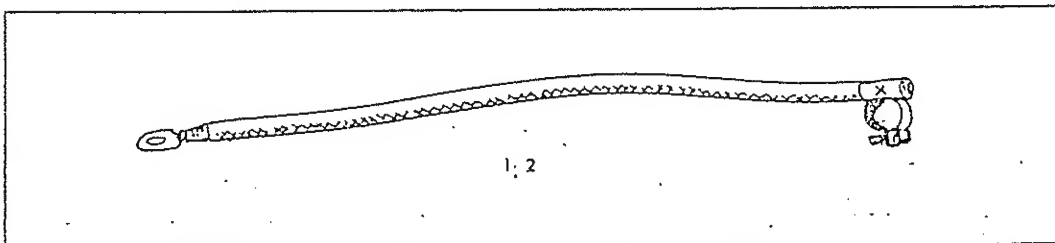


Fig 1 - BATTERY LEAD GROUP

KEY	PART NO.	QTY	DESCRIPTION
1	351/GMP/XA162P	1	Lead, Battery - Positive (Replaces X126A)
2	351/GMP/XA162H	1	Lead, Battery - Negative (Replaces X126B)

service kits

101K115	1	Gasket Kit, Rear Bearing - Included in Plant Gasket Kit.
105-192	1	Gear Set, Timing (Camschaft Gear Includes Flyball Spacer and Plate.)
113-88	2	Ring Set Piston
120K161	1	Gasket Kit, Oil Pump
142-33	1	Gasket Kit, Carburettor
142K371	1	Parts Kit, Carburettor Repair
149K526	1	Parts Kit, Fuel Pump Repair
150K433	1	Booster Replacement Kit, Vacuum.
150K434	1	Diaphragm Replacement Kit, Vacuum Booster.
168K67	1	Gasket Kit, Plant

NOTES

Some early sets were fitted with a flywheel which has been replaced with a heavier type. Both items are completely interchangeable.

Part numbers 336A902 and 336A1070 (336A1239) Lead are listed in Parts Supplements. Both leads must be ordered under part number 334-28 as this is a standard lead whose length is sufficient for the specific requirements.

Ground stud 520A603 was replaced by 520A580 as it was found that rolled threads resulted in a thin unthreaded centre. 520A580 has cut threads to ensure that the stud cannot be screwed into the frame beyond the unthreaded portion.

Instrument Panel Lid. First 150 plants (contract KH/M/045) were fitted with ammeters and voltmeters of smaller dimensions than the later types. Consequently the apertures in panel lid differ. Always ascertain which type is required.

Ammeter and Voltmeter. First 150 were a smaller type than subsequent issues. Always ascertain which type is required.

Oil Drain Cock. Two types completely interchangeable. Earlier issues required $3/8$ " nipple and socket. Later version dispenses with these parts.
